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RESEARCH MEMORANDUM

INVESTIGATION OF STATIC PRESSURES AND BOUNDARY-LAYER CHARACTERISTICS ON THE FORWARD PARTS OF NINE FUSELAGES OF VARIOUS CROSS-SECTIONAL SHAPES AT $M_\infty = 2.01$

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INVESTIGATION OF STATIC PRESSURES AND BOUNDARY-LAYER CHARACTERISTICS ON THE FORWARD PARTS OF NINE FUSELAGES OF VARIOUS CROSS-SECTIONAL SHAPES AT $M_\infty = 2.01$

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SUMMARY

An investigation has been made in the Langley 4- by 4-foot supersonic pressure tunnel at a free-stream Mach number of 2.01 and at angles of attack to 15° of the static pressures and boundary-layer characteristics on the forward parts of nine fuselages of various cross-sectional shapes. Up to 8° angle of attack, the static-pressure distributions were of a type which might be expected on the basis of the cross-flow concept, with the most negative pressures occurring at the widest section of the fuselage. At higher angles of attack, boundary-layer separation tended to produce regions of high negative pressure on the top side (bottom side at negative angles) of the fuselages.

For either a single-scoop or twin-scoop installation mounted on the top side of the fuselage, use of the 45° teardrop fuselage will probably minimize the effects of boundary-layer separation on inlet performance to an angle of attack of 15°. If the scoop is located on top near the nose section, the 90° teardrop fuselage may be suitable to an angle of attack of 15° for a twin-scoop installation, and the horizontal ellipse or inverted 45° teardrop fuselages may be suitable to an angle of attack of 12° for a single-scoop installation. The 45° teardrop shape appeared to have no boundary-layer separation over the entire angle-of-attack range.

INTRODUCTION

The use of top- or side-mounted supersonic scoop inlets offers several advantages to the aircraft designer. These advantages include a minimization of foreign-object damage to the engine, easier installation of armament in the bottom of the fuselage, and lighter landing gear.

Research which has been conducted on scoop inlets mounted on the top of circular cross-sectional fuselages (refs. 1 and 2) has indicated that the fuselage boundary layer may adversely affect inlet performance at positive angles of attack. Consideration must therefore be given to the use of other fuselage shapes with top-mounted inlets. Very little information is available, however, concerning the local flow characteristics of fuselages with noncircular cross-sections.

An investigation has been undertaken in the Langley 4- by 4-foot supersonic pressure tunnel to study the flow characteristics of eight noncircular fuselages at a Mach number of 2.01 and at angles of attack to 15°. Static-pressure distributions and boundary-layer characteristics were determined on each fuselage at two stations behind the nose section. The boundary-layer surveys were limited to that part of the fuselage circumference where inlets might be located; the surveys were intended to indicate only the qualitative nature of the flow. For comparison purposes, similar data were also obtained on a circular fuselage. This report presents the results of the investigation described previously.

It should be mentioned that these data are also of significance in studying the lateral stability characteristics, fuselage load distributions, and other local interference effects.

Force data obtained from these fuselages are presented in reference 3.

SYMBOLS

M_l	local Mach number
M_∞	free-stream Mach number
p	local static pressure
p_∞	free-stream static pressure
p_t	free-stream total pressure
p_l'	measured impact pressure
P	pressure coefficient, $\frac{p - p_\infty}{.7p_\infty M_\infty^2}$

h distance of survey tube from fuselage surface, measured along path of survey, in.

δ boundary-layer thickness, in.

α angle of attack, deg

ϕ circumferential location on fuselage surface, deg (table I)

ψ survey path of boundary-layer rake measured with respect to vertical center line, deg (table I)

TUNNEL

The Langley 4- by 4-foot supersonic pressure tunnel is a single-return closed-throat tunnel capable of operating at Mach numbers from 1.4 to 2.0. The test section employs fixed side walls and flexible top and bottom walls. The nozzle contours are formed by pulling the flexible walls against fixed, but interchangeable, templates. The width and average height of the test section at a Mach number of 2.01 are 54.0 and 61.2 inches, respectively. An external source of dry air is provided to maintain a low-moisture content in the tunnel so that condensation effects may be avoided. The stagnation pressure can be varied from approximately 0.25 to 2.0 atmospheres.

MODELS

The general model arrangement and the various fuselage cross-sectional shapes are shown in figure 1. The basic circular fuselage had an ogival nose of fineness ratio 3.5 followed by a cylindrical afterbody. Each of the other fuselages had equal longitudinal area distribution as the circular fuselage. From 11 to 16 static-pressure orifices (the number varied with cross-sectional shape) were located around one-half the circumference of each fuselage at stations 15 and 23. The boundary-layer surveys were made at stations 15 and 23 by means of a six-tube rake shown in figures 1 and 2. The rake tubes were always alined with the fuselage axis and had outside and inside diameters of 0.060 and 0.040 inch, respectively. The three tubes closest to the fuselage were flattened until the opening height was 0.020 inch. The rake and associated traverse mechanism was attached to the fuselage by means of support brackets and stub wings. The rake was positioned on the various fuselages by using support brackets of appropriate shapes. Since the rake tubes moved as a unit, they did not always move outward along lines perpendicular to the local fuselage surface.

The designation of the cross-sectional shapes used in figure 1 will be followed in the remainder of the report.

TESTS AND ACCURACY

The tests were conducted at a stagnation pressure of 15 pounds per square inch absolute at a Mach number of 2.01. The Reynolds number per foot of length was 3.7×10^6. During all the tests the moisture content of the air in the tunnel was maintained at a value low enough to prevent condensation effects in the test section. Boundary-layer transition strips were located about 1.0 inch behind the nose of the model.

The pressure data were photographically recorded on an inclined multiple-tube manometer filled with mercury. For these tests, the effective specific gravity of the mercury was about 6.8. Visual data plots of the three-rake-tube readings closest to the fuselage were made during each test run to facilitate the boundary-layer surveys. These readings were obtained from a vertical mercury manometer.

The apparatus used for the boundary-layer surveys was not ideally suited for its purpose because of the possibility of downstream blockage having some effect on the separated-flow regions. The apparatus was designed to be used with existing fuselage models which could not accommodate an internal mechanism to drive the rakes. An attempt was made to minimize these blockage effects by mounting the survey mechanism at an appreciable distance above the model surface. (See fig. 2.) It is believed that these surveys do indicate the qualitative nature of the flow. This point of view is substantiated by static-pressure-distribution data, not presented herein, obtained on several fuselages with and without the rake and survey mechanism in place. For these two conditions, the distributions were the same throughout the angle-of-attack range. Similarly, the static pressures were the same when the rake was located at two circumferential positions on a fuselage. If the survey mechanism was producing a significant effect on the boundary-layer characteristics, the fuselage static pressures would have varied for these different configurations.

The survey rake tubes were alined with the fuselage axis during these tests. Consequently, at the higher angles of attack, the rake tubes may have been at high local angles of attack. The survey data presented herein have not been corrected for this possible error.

The accuracy of the static-pressure-coefficient data is estimated to be ± 0.003.

PRESENTATION OF RESULTS

The static-pressure distributions around the nine fuselages at stations 15 and 23 are presented in figure 3 as a function of the circumferential location ϕ and angle of attack α. For the symmetrical bodies on which data were obtained at both positive and negative angles, the data obtained at -8° and -15° have been plotted with $\phi = 0^\circ$ on the bottom instead of on the top of the fuselage so that these data may be compared with the positive angle data. In figure 4 the pressure distributions are presented in polar-coordinate form to illustrate the relationship between the pressures and the fuselage shape.

The boundary-layer surveys were made only at circumferential positions where inlets might be located. These surveys were intended to be of a qualitative nature and, as a result, no attempt was made to determine in great detail the flow characteristics in the separated regions.

Typical boundary-layer survey data obtained at station 23 on the 45° teardrop fuselage are presented in figure 5. The ratio p_l'/p_t, the measured impact pressure to the free-stream total pressure, is plotted as a function of the tube traverse position h and the angle of attack. As has already been mentioned, the survey path of each tube was not necessarily perpendicular to the model surface. The distance h is measured along the survey path and is not necessarily the perpendicular distance from the fuselage to the survey tube. All the boundary-layer survey data are tabulated in table I. These data have not been corrected for errors introduced when the local flow was at an angle of attack with respect to the survey tube. These errors are probably not significant until the local angle exceeds 15°. The data for the circular and 90° teardrop shapes were obtained from visual records. Since visual data were recorded only for the three tubes closest to the fuselage, the values of h are limited to less than 0.8 inch.

In figure 6, the boundary-layer data are presented in the form of contour lines of constant p_l'/p_t. The boundary-layer thickness δ at $\alpha = 0^\circ$ and the locations of the rake-survey paths are included on the part of each figure for $\alpha = 0^\circ$. The boundary-layer height has been defined as the height at which the velocity is 99 percent of the local velocity. An indication of the local Mach number of the flow field may be obtained from the Mach number data presented in figure 6. These Mach numbers are based on the surface static pressure and the free-stream total pressure. These Mach numbers have been omitted in regions of boundary-layer separation where their significance may be doubtful. In figure 7 the boundary-layer data are summarized for comparison purposes.

DISCUSSION

Static Pressure Distributions

For most of the fuselage shapes considered in this report no information is available on the theoretical pressure distributions at small angles of attack. However, on the basis of the cross-flow concept (ref. 4) the most negative pressure at small angles of attack might be expected to occur at the widest point of the cross section. The data presented in figures 3 and 4 indicate that this is, in general, true for angles of attack up to about 8°. At 8° the pressure distributions at station 23 on the square, diamond, tent, triangle, and horizontal-ellipse cross sections (figs. 4(b), 4(c), 4(d), 4(g), and 4(h)) either reexpand slightly or maintain a relatively high negative pressure on the downstream side (top of fuselage at positive angles, bottom at negative angles) of the fuselage in a region where the pressure would be expected to become more positive. The fact that the pressure does not become more positive indicates that a small amount of separation has occurred.

At angles greater than 8°, the viscous cross-flow effects become predominant on most of the fuselages, and the pressure distributions vary appreciably from those at smaller angles of attack. A region of high negative pressure develops on the top side of most of the fuselages. These viscous cross-flow effects are least noticeable on the circle, 90° teardrop, 45° teardrop, and vertical-ellipse shapes at station 15, and on the 45° teardrop and tent (negative angles only) shapes at station 23. On some of the fuselages, there are appreciable differences at a given value of α between the distributions at stations 15 and 23. These differences are especially apparent on the fuselages with the following cross sections: circular (figs. 3(a) and 4(a)), tent (figs. 3(d), 3(e), and 4(d)), 90° teardrop (figs. 3(f), 3(g), and 4(e)), and vertical ellipse (figs. 3(m) and 4(i)).

The maximum positive pressure coefficients at a given angle of attack were about the same at both stations on the nine fuselages and varied from 0.003 to 0.029 at 8° and from 0.092 to 0.135 at 15°. The peak negative coefficients varied by greater amounts and are tabulated in the following table:

Fuselage shape	Values of peak negative coefficients at -							
	$\alpha = 8^\circ$	$\alpha = -8^\circ$	$\alpha = 15^\circ$	$\alpha = -15^\circ$	$\alpha = 8^\circ$	$\alpha = -8^\circ$	$\alpha = 15^\circ$	$\alpha = -15^\circ$
	Station 15				Station 23			
Circle	-0.105	------	-0.217	------	-0.092	------	-0.233	------
Square	-.135	------	-.169	------	-.091	------	-.213	------
Diamond	-.158	------	-.243	------	-.126	------	-.192	------
Tent	-.130	-0.120	-.195	-0.192	-.086	-0.110	-.193	-0.210
90° teardrop	-.106	-.107	-.218	-.212	-.096	-.087	-.215	-.176
45° teardrop	-.083	-.115	-.192	-.187	-.093	-.072	-.232	-.144
Triangle	-.128	-.178	-.232	-.219	-.165	-.089	-.240	-.154
Horizontal ellipse	-.155	------	-.240	------	-.133	------	-.196	------
Vertical ellipse	-.085	------	-.158	------	-.062	------	-.183	------

Boundary-Layer Characteristics

The boundary-layer characteristics of the nine fuselages (figs. 6 and 7) varied appreciably with shape at a given angle of attack. The boundary layer thinned, as would be expected, on the bottom of the fuselages at positive angles and on the top at negative angles. On the opposite side, the boundary layer tended to thicken as the angle of attack increased and then to separate and form the characteristic vortex type of flow. The following table summarizes the maximum test values of α at which flow without separation existed on the parts of the fuselages which were surveyed:

Fusélage shape	Values of α, deg at -	
	Station 15	Station 23
Circle	8	4
Square	8	4
Diamond	8	8
Tent	12, -8	± 4
90° teardrop	15, -8	8, -4
45° teardrop	15, -12	15, -8
Triangle	± 8	8, -4
Horizontal ellipse	12	4
Vertical ellipse	8	4

It should be mentioned that some of the data indicated that the amount of separation was small at the next higher test value of α (for example,

figs. 6(b), and 6(l)) and that some of the angles listed in the preceding table may be conservative by 2° or 3°. The data indicated that separation is delayed to at least 15° angle of attack at station 15 by either the 45° or 90° teardrop shape and to 15° at station 23 by the 45° teardrop shape.

Some general effects of fuselage shape on the boundary-layer-separation characteristics at positive angles of attack may be obtained from the data which is presented in figure 7. Streamlining the top of the circular-fuselage cross section - changing from a circular to a 45° teardrop shape - has a significant effect on reducing the amount of boundary-layer separation. This effect is particularly evident at an angle of attack of 15° at station 23 (fig. 7(d)). Streamlining the bottom of the fuselage cross-section - changing from a circular to an inverted 45° teardrop shape - while maintaining a circular top shape has no significant effect on the separation characteristics. If the top sides of the fuselage must have a 90° included angle, the data indicate that the 90° teardrop shape will probably minimize the separation to a greater degree over the angle-of-attack range than will either the diamond or tent shapes.

Selection of Fuselage Shapes for Use With Top-Mounted Scoop Inlets

Several factors such as local Mach number, boundary-layer characteristics, and cross-flow angle of attack must be taken into account in the selection of a fuselage shape most likely to provide a good performance for an inlet mounted on top of a fuselage. Probably the most important of these factors are the boundary-layer characteristics because of the large effect which may be produced on inlet pressure recovery. For a twin-duct installation, the 45° or 90° teardrop shapes appear to be most suitable if angles of attack approaching 15° are to be encountered and the inlet is located near the nose section. If the inlet is mounted farther rearward, the 45° teardrop shape appears to be most suitable. On these shapes it appears desirable to locate the inlet high on the fuselage to avoid the high local Mach numbers which occur as ϕ approaches 90°. The local Mach numbers on the 45° teardrop shape appear to be slightly lower than on the 90° teardrop. (See figs. 6(k), 6(m), 6(o), and 6(q).) Location of the inlet at station 23 may increase the inlet pressure recovery inasmuch as the local Mach number is about 0.1 less but will tend to increase the inlet drag because of the thicker boundary layer which must be diverted.

For a single-duct installation which must operate at high angles of attack, the horizontal-ellipse or inverted 45° teardrop shapes appear suitable up to 12° for an inlet location near the nose section. If the inlet width is restricted to about 30 percent of the fuselage width and the inlet is located near the nose section, the inverted-triangle or

inverted 90° teardrop shapes may be used up to about 12°. The 45° teardrop shape should be satisfactory to 15° although some difficulty may be encountered in incorporating a relatively large single inlet on the narrow fuselage top. As the angle-of-attack requirements for either inlet installation decrease, other fuselage shapes become acceptable. (See "Boundary-Layer Characteristics.")

CONCLUSIONS

An investigation has been made at a free-stream Mach number of 2.01 and at angles of attack to 15° of the static pressures and the boundary-layer characteristics on the forward parts of nine fuselages of various cross-sectional shapes. The following conclusions have been obtained:

(1) Up to an angle of attack of 8°, the static-pressure distributions were, in general, of a type which might be expected on the basis of the cross-flow concept. The most positive pressures occurred on the bottom of the fuselages (top at negative angles), and the most negative pressures occurred at or near the widest section of the fuselage. At the higher angles of attack, the boundary-layer separation tended to produce regions of high negative pressures on the top side of the fuselages.

(2) The 45° teardrop shape was the only shape investigated which appeared to be without boundary-layer separation over the complete angle-of-attack range at both fuselage survey stations.

(3) For a twin-inlet installation located on top of the fuselage near the nose section, use of the fuselage with the 45° or the 90° teardrop cross section will probably minimize the effects of boundary-layer separation on inlet performance to an angle of attack of 15°. For inlets located farther downstream, the 45° teardrop shape is most suitable.

(4) For a single-inlet installation located near the nose section, use of the fuselage with the horizontal-ellipse or inverted 45° teardrop cross-section will probably be suitable to an angle of attack of 12°. The 45° teardrop shape may be satisfactory to an angle of attack of 15°, although the inlet would probably be relatively narrow with respect to the fuselage.

Langley Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., August 24, 1956.

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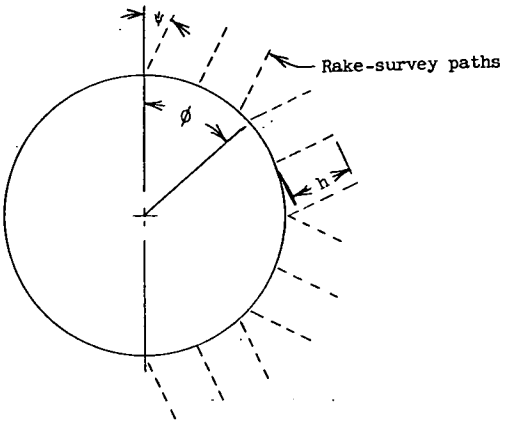
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TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA

(a) Circular cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	22	42
26	0	0.11	0.467	0.520	0.512
		.21	.656	.676	.675
		.26	.675	.680	.680
		.31	.675	.681	.681
26	4	0.11	0.386	0.444	0.461
		.21	.508	.611	.640
		.26	.585	.661	.661
		.31	.638	.666	.661
		.36	.661	.668	.663
		.41	.665	.665	.667
26	8	0.11	0.351	0.345	0.403
		.21	.442	.509	.603
		.26	.484	.595	.641
		.31	.536	.650	.640
		.36	.576	.658	.643
		.41	.623	.659	.648
		.46	.653	.657	.647
		.71	.654	.652	.658
26	12	0.11	0.514	0.258	0.305
		.26	.356	.421	.584
		.31	.564	.529	.622
		.41	.567	.546	.623
		.51	.647	.645	.629
		.71	.647	.645	.633
26	15	0.11	0.595	0.351	0.194
		.21	.607	.278	.324
		.31	.626	.320	.560
		.36	.632	.400	.576
		.41	.607	.509	.578
		.51	.651	.613	.589
		.61	.643	.619	.596

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	22	42
26	0	0.10	0.386	0.374	0.399
		.25	.604	.629	.649
		.30	.670	.690	.699
		.35	.696	.704	.706
		.40	.700	.704	.709
26	4	0.10	0.292	0.283	0.321
		.20	.379	.408	.471
		.30	.475	.546	.616
		.40	.581	.675	.699
		.50	.668	.704	.703
		.60	.704	.706	.703
26	8	0.10	0.473	0.244	0.209
		.30	.565	.306	.460
		.45	.617	.507	.685
		.50	.633	.595	.693
		.65	.693	.696	.696
		.70	.701	.696	.696
		.80	.705	.699	.697
26	12	0.10	0.640	0.416	0.339
		.30	.679	.299	.321
		.35	.688	.281	.281
		.40	.706	.321	.562
		.50	.702	.264	.398
		.70	.708	.541	.635
26	15	0.10	0.655	0.281	0.340
		.30	.686	.223	.316
		.35	.685	.210	.285
		.40	.694	.195	.271
		.60	.687	.177	.265
		.80	.688	.210	.242

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(a) Circular cross-section fuselage - Concluded

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			48	68	90
64	8	0.10	0.486	0.550	0.523
		.15	.587	.580	.569
		.21	.622	.583	.574
		.26	.625	.587	.578
64	15	0.10	0.185	0.339	0.363
		.21	.449	.379	.397
		.26	.514	.339	.409
		.31	.522	.338	.419
		.42	.536	.370	.434
		.62	.546	.397	.468
		.78	.563	.429	.468

			90	112	132
116	0	0.05	0.418	0.476	0.429
		.10	.571	.613	.567
		.15	.650	.668	.662
		.21	.670	.674	.677
		.26	.673	.675	.678
		.42	.671	.674	.671
116	8	0.05	0.496	0.573	0.562
		.10	.598	.658	.686
		.15	.628	.664	.691
		.21	.631	.664	.686
116	15	0.05	0.445	0.593	0.682
		.08	.495	.622	.697
		.10	.512	.621	.698
		.15	.523	.627	.700
		.21	.534	.633	.698

			138	158	180
154	8	0.08	0.490	0.633	0.574
		.11	.634	.694	.639
		.16	.697	.716	.719
		.21	.695	.715	.721
154	15	0.08	0.559	0.737	0.654
		.11	.692	.755	.761
		.16	.709	.756	.776
		.21	.713	.758	.778

Station 23

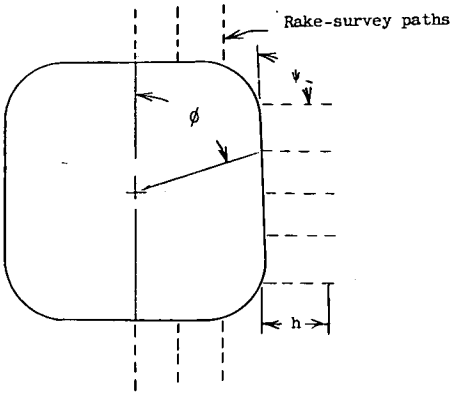
ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			48	68	90
64	4	0.10	0.320	0.343	0.443
		.20	.473	.515	.591
		.25	.552	.607	.659
		.30	.642	.668	.670
		.40	.704	.681	.671
		.45	.700	.683	.677
		.50	.701	.684	.676
64	8	0.10	0.215	0.283	0.405
		.15	.271	.482	.517
		.20	.354	.534	.577
		.25	.452	.605	.590
		.30	.555	.636	.595
		.35	.637	.638	.596
		.40	.673	.637	.601
		.50	.680	.642	.610
64	12	0.10	0.319	0.175	0.345
		.15	.372	.177	.384
		.20	.344	.198	.409
		.30	.238	.401	.421
		.40	.327	.553	.441
		.60	.604	.566	.464
64	15	0.10	0.289	0.344	0.366
		.15	.439	.391	.439
		.20	.476	.385	.450
		.30	.420	.252	.442
		.50	.373	.452	.419
		.70	.302	.515	.414

			90	112	132
116	0	0.10	0.425	0.388	0.387
		.30	.689	.695	.693
		.35	.700	.706	.708
		.40	.700	.706	.710
116	8	0.10	0.488	0.496	0.541
		.15	.577	.608	.646
		.20	.629	.661	.684
		.25	.639	.667	.696
		.30	.645	.669	.691
		.35	.648	.671	.692
116	15	0.10	0.446	0.470	0.625
		.15	.523	.580	.680
		.20	.500	.611	.680
		.25	.489	.617	.690
		.28	.497	.621	.693
		.30	.499	.623	.692
		.35	.513	.631	.695

			138	158	180
154	8	0.10	0.539	0.558	0.618
		.15	.648	.671	.703
		.20	.693	.703	.722
		.30	.695	.707	.723
154	15	0.10	0.603	0.648	0.716
		.15	.683	.730	.775
		.20	.699	.735	.778
		.30	.703	.741	.778
		.40	.711	.741	.775

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(b) Square cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	18	35
0	0	0.11	0.436	0.481	0.577
		.16	.535	.571	.656
		.21	.643	.666	.680
		.26	.677	.683	.682
		.31	.676	.682	.680
		1.11	.686	.687	.569
		1.16	.684	.684	.568
		1.21	.686	.686	.569
		1.26	.688	.688	.570
		1.31	.689	.689	.570
0	8	0.11	0.348	0.438	0.244
		.26	.545	.586	.498
		.36	.627	.650	.628
		.41	.657	.665	.644
		.46	.664	.666	.644
		.56	.665	.666	.647
		1.11	.669	.671	.588
		1.26	.670	.671	.588
		1.36	.672	.672	.589
		1.41	.674	.675	.592
		1.46	.673	.673	.590
		1.56	.675	.674	.590
0	12	0.11	0.453	0.542	0.373
		.16	.553	.552	.361
		.21	.606	.549	.346
		.31	.627	.555	.246
		.51	.652	.638	.526
		.71	.649	.649	.605
		1.11	.669	.666	.592
		1.16	.670	.668	.594
		1.21	.668	.668	.592
		1.31	.670	.670	.591
		1.51	.673	.672	.592
		1.71	.676	.675	.592

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	18	35
0	0	0.10	0.382	0.400	0.465
		.25	.616	.630	.686
		.30	.684	.690	.701
		.35	.702	.702	.701
		.42	.704	.705	.701
		1.10	.706	.707	.516
		1.25	.705	.706	.516
		1.30	.706	.706	.516
		1.35	.706	.706	.517
		1.42	.707	.707	.516
0	4	0.10	0.277	0.435	0.273
		.20	.372	.574	.335
		.30	.487	.654	.440
		.40	.607	.702	.572
		.50	.701	.710	.680
		.60	.709	.709	.700
		.70	.709	.709	.701
		1.10	.713	.712	.728
		1.20	.711	.711	.727
		1.30	.712	.712	.727
		1.40	.712	.712	.728
		1.50	.712	.711	.727
		1.60	.711	.711	.727
		1.70	.711	.710	.727
0	8	0.10	0.368	0.571	0.446
		.20	.487	.640	.377
		.30	.589	.655	.306
		.40	.651	.673	.293
		.50	.693	.687	.315
		.60	.707	.699	.330
		.70	.709	.698	.484
		.75	.710	.704	.575
		1.10	.713	.713	.728
		1.20	.713	.713	.728
		1.30	.714	.713	.728
		1.40	.715	.714	.728
		1.50	.715	.715	.727
		1.60	.716	.715	.727
		1.70	.714	.713	.728
		1.75	.714	.714	.727

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(b) Square cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	18	35
0	15	0.11	0.461	0.588	0.469
		.21	.597	.570	.384
		.26	.615	.557	.330
		.31	.618	.559	.304
		.51	.621	.563	.269
		.71	.628	.598	.288
		1.11	.655	.650	.592
		1.21	.662	.657	.594
		1.26	.662	.656	.591
		1.31	.664	.658	.592
		1.51	.671	.667	.593
		1.71	.676	.670	.593

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	18	35
0	12	0.10	0.549	0.606	0.505
		.20	.643	.655	.609
		.30	.673	.654	.529
		.40	.673	.654	.395
		.50	.673	.646	.300
		.60	.672	.635	.271
		.70	.675	.631	.258
		.75	.677	.623	.258
		1.10	.694	.681	.728
		1.20	.699	.686	.727
		1.30	.704	.694	.728
		1.40	.708	.699	.728
		1.50	.711	.703	.728
		1.60	.713	.706	.727
		1.70	.715	.709	.727
		1.75	.716	.710	.728
0	15	0.10	.632	.613	.348
		.20	.644	.627	.584
		.30	.641	.623	.621
		.40	.637	.617	.611
		.50	.632	.604	.569
		.60	.624	.573	.448
		.70	.617	.516	.370
		.75	.613	.473	.354
		1.10	.618	.412	.728
		1.20	.628	.420	.727
		1.30	.640	.448	.728
		1.40	.651	.492	.728
		1.50	.661	.565	.727
		1.60	.671	.622	.728
		1.70	.683	.654	.729
		1.75	.689	.662	.729

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(b) Square cross-section fuselage - Concluded

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			55	72	90
90	0	0.09	0.447	0.356	0.312
		.14	.527	.439	.395
		.29	.703	.675	.633
		.34	.705	.704	.688
		.39	.704	.705	.702
		1.09	.710	.710	.710
		1.14	.710	.709	.709
		1.24	.711	.709	.709
		1.29	.708	.708	.708
		1.34	.708	.708	.708
		1.39	.706	.707	.707
90	8	0.09	0.428	0.365	0.317
		.19	.632	.583	.560
		.24	.669	.666	.648
		.29	.671	.676	.663
		.34	.672	.676	.663
		1.09	.695	.684	.676
		1.19	.696	.684	.677
		1.24	.697	.685	.677
		1.29	.696	.684	.678
		1.34	.696	.685	.678
90	15	0.09	0.337	0.363	0.322
		.19	.553	.565	.552
		.24	.599	.593	.582
		.29	.606	.597	.585
		.34	.603	.595	.584
		1.09	.696	.624	.613
		1.19	.697	.626	.616
		1.24	.697	.628	.617
		1.29	.698	.630	.620
		1.34	.697	.629	.620

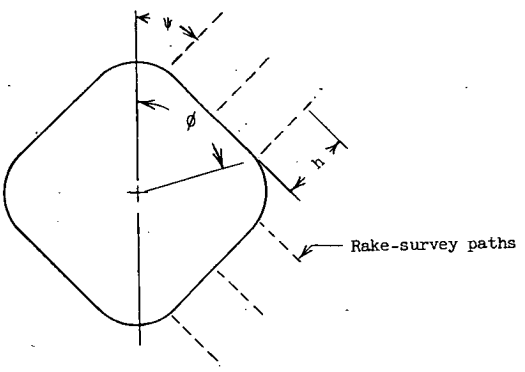
Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			90	108	125
90	8	0.09	0.338	0.381	0.529
		.19	.573	.607	.628
		.24	.643	.642	.636
		.29	.655	.645	.640
		.34	.656	.648	.642
		1.09	.682	.676	.674
		1.19	.683	.676	.675
		1.24	.682	.676	.675
		1.29	.681	.675	.674
		1.34	.680	.675	.673
90	15	0.07	0.293	0.213	0.311
		.09	.380	.241	.388
		.19	.550	.503	.442
		.24	.571	.525	.463
		.29	.573	.530	.487
		.34	.574	.536	.511
		1.07	.625	.614	.630
		1.09	.626	.615	.633
		1.19	.630	.620	.632
		1.24	.630	.620	.632
		1.29	.632	.623	.631
		1.34	.634	.625	.633

			145	162	180
180	8	0.10	0.621	0.583	0.588
		.15	.694	.685	.684
		.20	.701	.717	.720
		.25	.704	.721	.724
		1.10	.706	.723	.725
		1.15	.716	.722	.724
		1.20	.717	.722	.724
		1.25	.717	.723	.724
180	15	0.10	0.692	0.695	0.706
		.15	.729	.759	.764
		.20	.735	.770	.775
		.25	.741	.771	.775
		1.10	.739	.774	.777
		1.15	.741	.772	.775
		1.20.	.741	.772	.775
		1.25	.742	.772	.775

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(c) Diamond cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ø, deg		
			15	45	75
45	0	0.10	0.491	0.432	0.476
		.15	.598	.525	.593
		.20	.678	.629	.673
		.30	.680	.677	.677
45	4	0.10	0.386	0.410	0.376
		.20	.567	.614	.599
		.25	.641	.662	.642
		.30	.665	.664	.646
		.46	.670	.667	.651
45	8	0.10	0.349	0.409	0.245
		.20	.541	.586	.507
		.30	.654	.633	.576
		.39	.659	.639	.588
		.50	.657	.643	.597
45	12	0.05	0.243	0.342	0.147
		.10	.357	.464	.236
		.20	.553	.578	.192
		.30	.626	.605	.187
		.50	.644	.602	.417
		.70	.660	.599	.478
45	15	0.05	0.273	0.469	0.121
		.10	.412	.357	.169
		.20	.627	.233	.271
		.30	.637	.200	.252
		.50	.638	.359	.260
		.70	.640	.465	.377

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ø, deg		
			15	45	75
45	0	0.03	0.287	0.271	0.270
		.13	.486	.416	.474
		.18	.566	.482	.553
		.23	.658	.564	.636
		.33	.704	.687	.698
		.53	.705	.700	.698
		1.03	.707	.707	.707
		1.13	.707	.707	.707
		1.18	.707	.707	.707
		1.23	.706	.706	.706
		1.33	.706	.706	.706
		1.53	.705	.705	.705
45	4	0.03	0.220	0.293	0.188
		.23	.436	.621	.451
		.33	.571	.698	.597
		.43	.688	.700	.669
		.53	.707	.702	.675
		1.03	.709	.706	.703
		1.23	.709	.706	.703
		1.33	.709	.707	.702
		1.43	.709	.707	.702
		1.53	.710	.707	.703
45	8	0.03	0.220	0.409	0.163
		.13	.331	.515	.243
		.33	.617	.621	.371
		.53	.701	.675	.591
		.73	.704	.677	.610
		1.03	.710	.691	.672
		1.13	.709	.692	.675
		1.33	.709	.694	.679
		1.53	.708	.695	.682
		1.73	.709	.696	.685

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(c) Diamond cross-section fuselage - Concluded

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			105	135	165
135	8	0.05	0.283	0.387	0.372
		.10	.488	.549	.607
		.15	.621	.669	.717
		.20	.661	.701	.720
		.30	.667	.703	.720
135	15	0.05	0.310	0.455	0.448
		.10	.500	.649	.750

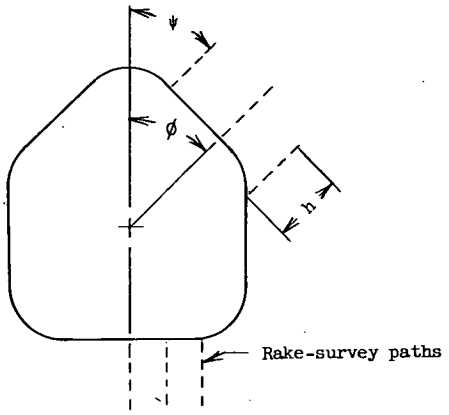
Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			15	45	75
45	12	0.03	0.255	0.375	0.214
		.07	.319	.488	.222
		.17	.391	.543	.223
		.37	.632	.353	.463
		.57	.685	.247	.379
		.77	.684	.391	.338
		1.03	.691	.582	.554
		1.07	.691	.589	.558
		1.17	.692	.605	.570
		1.37	.692	.628	.589
		1.57	.693	.645	.607
		1.77	.694	.654	.622
45	15	0.07	0.441	0.317	0.297
		.17	.511	.379	.259
		.27	.625	.372	.265
		.47	.637	.265	.388
		.67	.631	.188	.482
		.87	.626	.167	.414

			105	135	165
135	8	0.03	0.282	0.389	0.401
		.13	.551	.610	.693
		.23	.659	.697	.712
		.33	.665	.698	.713
		1.03	.688	.704	.713
		1.13	.690	.704	.713
		1.23	.691	.703	.712
		1.33	.692	.704	.712
135	15	0.03	0.292	0.453	0.482
		.07	.440	.582	.622
		.13	.582	.712	.762
		.23	.660	.738	.763
		.39	.675	.741	.765
		1.03	.705	.742	.762
		1.07	.708	.743	.763
		1.13	.708	.743	.763
		1.23	.710	.742	.762
		1.39	.713	.743	.761

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(d) Tent cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			17	45	73
45	0	0.09	0.511	0.431	0.466
		.14	.648	.557	.564
		.19	.680	.642	.636
		.24	.680	.673	.670
		.29	.679	.674	.674
		1.09	.688	.686	.683
		1.14	.688	.689	.684
		1.19	.690	.689	.685
		1.24	.692	.690	.687
		1.29	.691	.691	.688
45	8	0.09	0.405	0.341	0.476
		.14	.499	.441	.553
		.19	.596	.550	.605
		.24	.648	.602	.609
		.29	.656	.610	.610
		.34	.656	.610	.614
		1.09	.661	.646	.648
		1.14	.662	.649	.650
		1.19	.662	.650	.651
		1.24	.664	.652	.653
		1.29	.666	.654	.655
		1.34	.666	.656	.657
45	12	0.09	0.375	0.274	0.438
		.19	.546	.463	.528
		.24	.617	.532	.530
		.29	.641	.541	.527
		.34	.642	.544	.528
		1.09	.646	.611	.600
		1.19	.649	.616	.604
		1.24	.650	.620	.609
		1.29	.652	.621	.612
		1.34	.652	.624	.616

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			17	45	73
45	0	0.10	0.395	0.359	0.412
		.25	.650	.596	.588
		.30	.694	.661	.645
		.35	.705	.697	.693
		1.10	.705	.705	.705
		1.25	.705	.705	.705
		1.30	.706	.706	.705
		1.35	.704	.707	.705
45	4	0.10	0.426	0.282	0.327
		.30	.676	.532	.603
		.35	.691	.603	.665
		.40	.690	.647	.695
		.45	.691	.681	.705
		.50	.690	.690	.707
		.60	.694	.692	.707
		1.10	.699	.701	.706
		1.30	.697	.699	.705
		1.35	.700	.702	.708
		1.40	.699	.702	.706
		1.45	.699	.702	.706
		1.50	.699	.702	.705
		1.60	.700	.702	.706
45	8	0.10	0.461	0.255	0.371
		.20	.611	.223	.500
		.25	.632	.234	.543
		.30	.647	.296	.587
		.40	.651	.543	.678
		.45	.654	.623	.697
		.60	.661	.652	.698
		1.10	.676	.683	.701
		1.20	.680	.687	.704
		1.25	.681	.688	.705
		1.30	.680	.688	.704
		1.40	.679	.688	.703
		1.45	.682	.690	.704
		1.60	.682	.689	.704

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(d) Tent cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			17	45	73
45	15	0.04	0.279	0.273	0.328
		.14	.506	.195	.493
		.14	.518	.192	.500
		.19	.609	.178	.503
		.24	.636	.153	.499
		.34	.637	.276	.493
		.49	.632	.417	.494
		.59	.634	.449	.495
		.69	.631	.473	.501
		1.04	.626	.556	.549
		1.14	.629	.567	.559
		1.14	.628	.567	.559
		1.19	.631	.571	.563
		1.24	.631	.575	.566
		1.34	.634	.583	.576
		1.49	.638	.594	.589
		1.59	.640	.600	.595
		1.69	.641	.606	.601
45	-8	0.14	0.718	0.663	0.601
		.19	.718	.699	.644
		.24	.717	.697	.647
		1.14	.724	.716	.693
		1.19	.725	.716	.695
		1.24	.724	.716	.695
45	-15	0.04	0.383	0.329	0.273
		.09	.677	.463	.466
		.14	.762	.704	.522
		.19	.763	.726	.549
		.24	.764	.726	.549
		1.04	.771	.742	.693
		1.09	.770	.742	.697
		1.14	.771	.745	.704
		1.19	.773	.747	.703
		1.24	.772	.748	.705

ψ, deg	α, deg	h, in.	147	162	180
180	0	0.10	0.524	0.472	0.432
		.15	.623	.574	.539
		.20	.675	.654	.625
		.25	.679	.679	.673
		.30	.680	.681	.677
		1.10	.691	.689	.687
		1.15	.691	.690	.688
		1.20	.692	.692	.690
		1.25	.693	.693	.690
		1.30	.694	.695	.692

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			17	45	73
45	12	0.10	0.459	0.267	0.403
		.15	.518	.335	.464
		.20	.568	.365	.563
		.30	.585	.354	.682
		.50	.600	.280	.686
		.70	.610	.530	.682
		1.10	.632	.632	.684
		1.15	.634	.636	.685
		1.20	.634	.637	.685
		1.30	.636	.641	.686
		1.50	.641	.650	.689
		1.70	.646	.659	.692
45	15	0.10	0.448	0.229	0.478
		.15	.485	.236	.479
		.20	.512	.267	.512
		.30	.518	.362	.558
		.40	.541	.415	.435
		.50	.579	.415	.344
		.70	.578	.377	.302
		1.10	.613	.566	.565
		1.15	.613	.565	.588
		1.20	.613	.567	.602
		1.30	.617	.579	.618
		1.40	.618	.587	.630
		1.50	.617	.594	.638
		1.70	.621	.611	.651
45	-8	0.10	0.426	0.384	0.474
		.15	.527	.564	.657
		.20	.589	.665	.711
		.25	.642	.691	.713
		.30	.648	.690	.713
		.40	.651	.691	.714
		1.10	.682	.700	.713
		1.15	.681	.700	.712
		1.20	.683	.702	.713
		1.25	.684	.701	.713
		1.30	.684	.699	.712
		1.40	.687	.701	.712
45	-15	0.10	0.150	0.347	0.484
		.15	.224	.626	.746
		.20	.397	.708	.754
		.30	.531	.715	.755
		.40	.556	.717	.758
		.50	.574	.718	.757
		1.10	.672	.730	.756
		1.15	.674	.730	.756
		1.20	.676	.730	.754
		1.30	.684	.731	.755
		1.40	.687	.730	.753
		1.50	.695	.731	.753

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(d) Tent cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			147	162	180
180	8	0.10	0.664	0.620	0.577
		.15	.699	.704	.691
		.20	.703	.719	.719
		.25	.705	.720	.720
		1.10	.727	.732	.731
		1.15	.727	.733	.732
		1.20	.729	.734	.733
		1.25	.731	.735	.734
180	15	0.05	0.425	0.471	0.394
		.08	.571	.618	.548
		.10	.730	.740	.694
		.15	.735	.773	.777
		.20	.741	.775	.778
		1.05	.780	.791	.790
		1.08	.780	.789	.790
		1.10	.780	.785	.787
		1.15	.780	.787	.789
		1.20	.781	.789	.789
180	-4	0.10	0.366	0.384	0.324
		.20	.570	.578	.514
		.25	.624	.636	.584
		.30	.661	.670	.651
		.35	.666	.672	.670
		.40	.667	.673	.670
		1.10	.679	.681	.679
		1.20	.682	.681	.679
		1.25	.682	.682	.680
		1.30	.684	.683	.681
		1.35	.685	.684	.682
		1.40	.686	.685	.683
180	-8	0.10	0.220	0.431	0.354
		.25	.429	.559	.543
		.35	.594	.640	.630
		.40	.636	.671	.659
		.45	.642	.666	.664
		.55	.646	.670	.664
		1.10	.668	.675	.675
		1.25	.675	.676	.677
		1.35	.677	.678	.678
		1.40	.679	.680	.680
		1.45	.679	.680	.680
		1.55	.682	.682	.682

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			147	162	180
180	0	0.11	0.440	0.403	0.375
		.26	.680	.641	.611
		.31	.699	.688	.673
		.36	.702	.702	.698
		.41	.701	.703	.700
		1.11	.708	.708	.704
		1.26	.706	.706	.705
		1.31	.710	.706	.706
		1.36	.708	.706	.707
		1.41	.709	.706	.706
180	8	0.11	0.631	0.603	0.591
		.16	.689	.686	.672
		.21	.698	.719	.717
		.26	.703	.720	.719
		.31	.705	.721	.719
		1.11	.718	.721	.723
		1.16	.717	.723	.724
		1.21	.717	.723	.724
		1.26	.717	.723	.723
		1.31	.718	.723	.724
180	15	0.11	.692	.705	.701
		.16	.721	.758	.762
		.21	.728	.768	.773
		.26	.736	.770	.775
		.31	.742	.771	.775
		1.11	.764	.774	.777
		1.16	.762	.774	.778
		1.21	.763	.773	.777
		1.26	.763	.773	.777
		1.31	.763	.773	.776
180	-4	0.11	0.260	0.411	0.280
		.26	.386	.603	.439
		.33	.459	.652	.519
		.41	.571	.697	.619
		.51	.667	.705	.696
		.56	.693	.706	.704
		.61	.700	.708	.706
		.71	.701	.708	.707
		1.11	.709	.707	.709
		1.26	.708	.711	.709
		1.33	.708	.710	.709
		1.41	.706	.710	.710
		1.51	.708	.709	.711
		1.56	.709	.709	.709
		1.61	.711	.711	.711
		1.71	.710	.711	.710

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(d) Tent cross-section fuselage - Concluded

Station 15

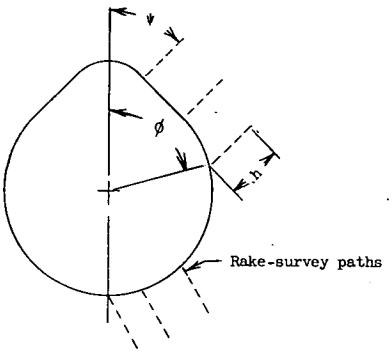
ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			147	162	180
180	-12	0.10	0.314	0.587	0.490
		.20	.377	.568	.579
		.25	.361	.562	.604
		.30	.347	.564	.620
		.40	.268	.580	.642
		.50	.379	.623	.655
		.70	.591	.643	.637
		1.10	.653	.665	.673
		1.20	.655	.669	.673
		1.25	.659	.672	.675
		1.30	.659	.672	.675
		1.40	.663	.674	.676
		1.50	.667	.677	.679
		1.70	.673	.681	.682
180	-15	0.05	0.185	0.476	0.311
		.10	.335	.584	.520
		.15	.489	.586	.582
		.20	.517	.579	.597
		.25	.475	.581	.608
		.40	.312	.548	.621
		.55	.285	.469	.602
		.70	.294	.511	.625
		1.05	.585	.643	.659
		1.10	.596	.647	.661
		1.15	.603	.649	.663
		1.20	.610	.652	.665
		1.25	.616	.656	.668
		1.40	.634	.664	.675
		1.55	.646	.667	.678
		1.70	.656	.674	.682

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			147	162	180
180	-8	0.11	0.428	0.589	0.388
		.21	.392	.622	.511
		.31	.325	.625	.590
		.41	.326	.628	.639
		.51	.321	.638	.686
		.61	.329	.667	.703
		.71	.469	.690	.706
		1.11	.700	.709	.711
		1.21	.703	.710	.714
		1.31	.705	.711	.713
		1.41	.706	.710	.714
		1.51	.706	.712	.713
		1.61	.707	.713	.712
		1.71	.708	.714	.714
180	-12	0.11	0.370	0.633	0.566
		.21	.588	.654	.653
		.26	.615	.646	.662
		.31	.599	.650	.667
		.51	.394	.626	.670
		.71	.306	.560	.670
		1.11	.409	.664	.692
		1.21	.428	.680	.697
		1.26	.641	.684	.698
		1.31	.513	.689	.701
		1.51	.662	.698	.707
		1.71	.682	.706	.702
180	-15	0.07	0.234	0.551	0.579
		.09	.271	.583	.659
		.11	.325	.614	.639
		.31	.622	.624	.639
		.51	.606	.609	.634
		.71	.452	.524	.616
		1.07	.302	.421	.616
		1.09	.303	.414	.619
		1.11	.306	.416	.620
		1.31	.352	.428	.640
		1.51	.413	.469	.663
		1.71	.457	.576	.686

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(e) 90° teardrop cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ø, deg		
			17	45	75
45	0	0.09	0.503	0.431	0.450
		.14	.638	.560	.571
		.19	.677	.652	.656
		.24	.678	.676	.676
		.29	.678	.679	.678
45	4	0.09	0.382	0.373	0.417
		.19	.597	.608	.643
		.24	.659	.654	.653
		.29	.669	.658	.654
		.34	.668	.659	.655
45	8	0.09	0.378	0.339	0.416
		.14	.488	.468	.546
		.19	.584	.568	.589
		.24	.647	.612	.595
		.29	.659	.618	.599
		.39	.659	.622	.608
45	12	0.09	0.338	0.264	0.349
		.14	.428	.411	.445
		.19	.523	.517	.469
		.24	.613	.559	.479
		.29	.646	.563	.489
		.39	.647	.568	.504
		.59	.647	.573	.530
45	15	0.09	0.345	0.179	0.309
		.14	.407	.237	.363
		.19	.481	.360	.378
		.24	.573	.458	.390
		.29	.656	.483	.397
		.39	.627	.497	.413
		.49	.629	.509	.431
45	-8	0.09	0.646	0.547	0.523
		.14	.704	.671	.622
		.19	.707	.691	.651
		.24	.707	.692	.658
		.29	.708	.695	.662
45	-15	0.09	0.705	0.529	0.462
		.14	.752	.712	.579
		.19	.753	.716	.595
		.29	.755	.719	.616
		.39	.759	.725	.634
		.49	.762	.724	.646

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ø, deg		
			17	45	75
45	0	0.10	0.425	0.405	0.406
		.25	.681	.644	.619
		.30	.704	.686	.667
		.35	.708	.705	.699
		.40	.708	.706	.703
45	4	0.10	0.339	0.329	0.378
		.25	.559	.566	.627
		.30	.624	.635	.676
		.35	.670	.675	.688
		.45	.707	.692	.690
		.55	.711	.694	.694
45	8	0.10	0.371	0.227	0.403
		.18	.450	.306	.547
		.25	.522	.431	.633
		.35	.637	.608	.649
		.42	.695	.657	.653
		.50	.707	.665	.659
		.60	.706	.665	.662
45	12	0.10	0.448	0.280	0.171
		.25	.529	.231	.478
		.32	.587	.234	.565
		.40	.657	.311	.576
		.60	.681	.548	.590
45	15	0.10	0.529	0.359	0.163
		.25	.644	.233	.312
		.32	.630	.202	.436
		.36	.605	.198	.493
		.40	.585	.201	.503
		.60	.616	.192	.515
		.80	.634	.336	.532
45	-8	0.10	0.550	0.470	0.356
		.15	.690	.624	.538
		.20	.714	.684	.604
		.25	.714	.692	.648
		.30	.715	.693	.654
		.40	.715	.696	.660
45	-15	0.10	0.546	0.451	0.339
		.15	.746	.654	.463
		.20	.754	.711	.551
		.25	.755	.712	.574
		.35	.755	.713	.592
		.50	.757	.721	.617

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(e) 90° teardrop cross-section fuselage - Concluded

Station 15

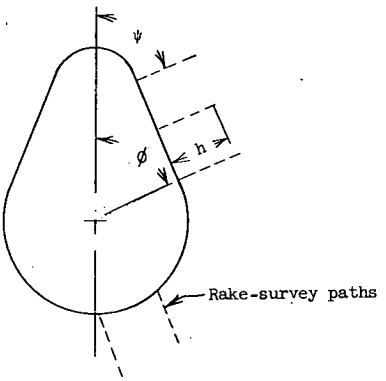
ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			136	161	180
150	0	0.06	0.336	0.368	0.358
		.13	.553	.582	.551
		.16	.640	.657	.645
		.22	.684	.686	.680
		.27	.686	.686	.682
150	8	0.06	0.369	0.501	0.536
		.13	.684	.327	.714
		.16	.706	.725	.728
		.22	.706	.725	.728
150	15	0.06	0.428	0.511	0.469
		.09	.613	.702	.645
		.11	.700	.770	.791
		.16	.723	.774	.784
		.27	.732	.775	.786
150	-8	0.06	0.255	0.263	0.314
		.22	.603	.529	.465
		.27	.637	.627	.527
		.32	.641	.665	.581
		.37	.645	.669	.629
		.43	.646	.669	.660
		.48	.649	.670	.672
		.79	.654	.672	.673
150	-12	0.06	0.182	0.236	0.530
		.22	.532	.334	.568
		.27	.598	.421	.582
		.37	.608	.620	.629
		.43	.611	.649	.658
		.54	.617	.654	.667
		.69	.618	.660	.666
		.79	.622	.658	.667
150	-15	0.06	0.172	0.404	0.602
		.27	.409	.281	.642
		.37	.542	.420	.649
		.43	.551	.557	.658
		.54	.563	.618	.665
		.64	.573	.629	.667
		.79	.582	.637	.667

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			136	161	180
150	0	0.05	0.343	0.349	0.335
		.13	.477	.469	.458
		.19	.585	.571	.545
		.24	.664	.653	.627
		.29	.699	.691	.680
		.34	.707	.705	.702
		.40	.699	.694	.683
		.39	.707	.706	.704
150	8	0.03	0.472	0.609	0.455
		.08	.548	.573	.607
		.13	.654	.676	.677
		.19	.693	.716	.721
		.24	.697	.715	.724
150	15	0.03	0.553	0.735	0.533
		.13	.696	.750	.769
		.19	.708	.762	.777
		.24	.713	.762	.778
150	-4	0.08	0.303	0.275	0.281
		.19	.444	.400	.388
		.29	.606	.538	.491
		.34	.670	.612	.551
		.37	.691	.653	.584
		.39	.696	.670	.601
		.45	.700	.700	.637
		.50	.699	.707	.679
		.55	.701	.708	.703
		.76	.701	.708	.707
150	-8	0.08	0.197	0.320	0.492
		.19	.277	.342	.551
		.29	.418	.333	.566
		.39	.593	.400	.630
		.50	.676	.540	.670
		.60	.681	.682	.703
		.71	.684	.700	.710
		.76	.684	.700	.709
150	-12	0.03	0.217	0.493	0.570
		.13	.391	.431	.643
		.24	.433	.327	.669
		.39	.329	.251	.691
		.60	.535	.322	.706
		.76	.604	.576	.708
150	-15	0.03	0.165	0.576	0.581
		.13	.355	.534	.668
		.29	.338	.439	.674
		.50	.256	.235	.686
		.66	.516	.483	.789
		.76	.513	.496	.789

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(f) 45° teardrop cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t ø, deg		
			17	35	64
67	0	0.05	0.335	0.312	0.305
		.10	.518	.462	.441
		.15	.642	.586	.569
		.20	.670	.656	.645
		.25	.671	.665	.656
		1.05	.679	.671	.674
		1.10	.682	.673	.677
		1.15	.682	.674	.678
		1.20	.682	.673	.677
		1.25	.682	.673	.677
67	4	0.05	0.324	0.294	0.301
		.15	.552	.483	.527
		.20	.643	.568	.613
		.25	.662	.636	.636
		.35	.664	.658	.636
		.45	.663	.658	.637
		1.05	.672	.665	.671
		1.15	.673	.667	.673
		1.20	.674	.667	.674
		1.25	.675	.668	.676
		1.35	.676	.669	.677
		1.45	.678	.671	.678
67	8	0.05	0.289	0.288	0.278
		.20	.569	.589	.587
		.25	.635	.627	.593
		.30	.646	.628	.593
		.40	.648	.631	.598
		1.05	.659	.648	.657
		1.20	.660	.652	.662
		1.25	.660	.654	.663
		1.30	.661	.654	.663
		1.40	.664	.656	.666

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t ø, deg		
			17	35	64
67	0	0.06	0.296	0.283	0.287
		.11	.420	.378	.389
		.16	.513	.456	.463
		.21	.606	.535	.534
		.26	.686	.628	.625
		.31	.705	.688	.676
		.41	.707	.705	.695
		.51	.708	.706	.695
		1.06	.704	.708	.709
		1.11	.704	.707	.709
		1.16	.703	.707	.709
		1.21	.703	.707	.709
		1.26	.704	.707	.710
		1.31	.703	.705	.709
		1.41	.705	.705	.711
		1.51	.705	.705	.710
67	4	0.06	0.250	0.284	0.270
		.16	.381	.456	.465
		.21	.442	.528	.538
		.25	.499	.590	.599
		.28	.543	.635	.640
		.31	.590	.670	.661
		.31	.582	.664	.657
		.36	.707	.702	.675
		.41	.693	.700	.672
		.51	.707	.701	.676
		.61	.707	.702	.676
		1.06	.707	.706	.704
		1.16	.706	.705	.704
		1.21	.705	.704	.703
		1.25	.705	.705	.704
		1.28	.704	.704	.704
		1.31	.704	.705	.704
		1.31	.704	.704	.703
		1.36	.704	.703	.705
		1.41	.704	.703	.705
		1.51	.705	.702	.705
		1.61	.705	.705	.705

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(f) 45° teardrop cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			17	35	64
67	12	0.05	0.288	0.280	0.256
		.15	.491	.507	.499
		.20	.582	.578	.521
		.25	.619	.589	.526
		.30	.621	.591	.530
		.40	.620	.592	.538
		1.05	.641	.623	.631
		1.15	.642	.628	.636
		1.20	.641	.627	.637
		1.25	.642	.629	.639
		1.30	.642	.631	.641
		1.40	.643	.634	.643
67	15	0.05	0.289	0.265	0.220
		.10	.403	.382	.374
		.15	.502	.487	.444
		.20	.583	.546	.455
		.25	.599	.551	.462
		.30	.599	.553	.468
		.40	.600	.554	.479
		.50	.596	.553	.485
		1.05	.620	.598	.598
		1.10	.623	.602	.603
		1.15	.623	.604	.606
		1.20	.621	.604	.607
		1.25	.622	.606	.610
		1.30	.622	.608	.613
		1.40	.624	.612	.619
		1.50	.626	.616	.625
67	-8	0.05	0.378	0.343	0.293
		.10	.648	.556	.508
		.15	.685	.656	.611
		.25	.687	.668	.638
		.35	.692	.671	.646
		.45	.694	.671	.647
		1.05	.699	.679	.664
		1.10	.703	.684	.666
		1.15	.701	.683	.667
		1.25	.704	.685	.669
		1.35	.708	.688	.672
		1.45	.710	.692	.675
67	-15	0.05	0.374	0.354	0.285
		.10	.722	.614	.498
		.15	.719	.687	.598
		.20	.720	.685	.610
		.30	.721	.687	.623
		.40	.725	.691	.632
		1.05	.733	.700	.664
		1.10	.735	.702	.666
		1.15	.739	.707	.669
		1.20	.739	.707	.671
		1.30	.741	.710	.674
		1.40	.745	.714	.679

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			17	35	64
67	8	0.11	0.340	0.336	0.372
		.21	.502	.519	.570
		.31	.653	.656	.617
		.41	.691	.671	.621
		.51	.692	.671	.625
		1.11	.701	.688	.679
		1.21	.701	.688	.681
		1.31	.699	.689	.681
		1.41	.699	.691	.682
		1.51	.698	.691	.684
67	12	0.11	0.330	0.296	0.319
		.21	.509	.513	.512
		.26	.575	.582	.519
		.31	.642	.613	.524
		.41	.666	.619	.531
		.51	.668	.621	.537
		1.11	.683	.653	.627
		1.21	.681	.655	.630
		1.26	.681	.656	.632
		1.31	.681	.657	.634
		1.41	.681	.659	.638
		1.51	.680	.662	.642
67	15	0.11	0.311	0.335	0.130
		.21	.448	.487	.352
		.26	.545	.548	.410
		.31	.619	.558	.424
		.41	.636	.558	.439
		.51	.637	.558	.453
		.71	.639	.562	.471
		1.11	.659	.608	.565
		1.21	.657	.610	.568
		1.26	.657	.611	.569
		1.31	.657	.613	.571
		1.41	.657	.616	.572
		1.51	.657	.618	.576
		1.71	.659	.622	.587
67	-8	0.11	0.566	0.511	0.489
		.16	.678	.638	.613
		.21	.691	.680	.660
		.26	.692	.682	.665
		.31	.692	.682	.667
		1.11	.694	.685	.680
		1.16	.696	.686	.681
		1.21	.696	.686	.680
		1.26	.696	.686	.680
		1.31	.696	.687	.681
67	-15	0.06	0.398	0.411	0.369
		.11	.677	.582	.489
		.16	.710	.678	.582
		.21	.709	.684	.610
		.26	.710	.684	.615
		.36	.715	.691	.628
		1.06	.717	.690	.659
		1.11	.718	.690	.659
		1.16	.718	.691	.661
		1.21	.718	.691	.662
		1.26	.719	.691	.663
		1.36	.723	.696	.667

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(f) 45° teardrop cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t	
			∅, deg	
			138	178
158	-4	0.05	0.244	0.260
		.15	.489	.403
		.21	.586	.458
		.26	.657	.523
		.31	.671	.577
		.36	.671	.640
		.41	.672	.673
		.46	.673	.681
		.52	.673	.683
158	-8	0.05	0.206	0.302
		.21	.516	.488
		.26	.613	.508
		.31	.652	.536
		.36	.655	.572
		.41	.657	.608
		.52	.662	.667
		.57	.662	.678
158	-12	0.10	0.190	0.593
		.21	.293	.621
		.26	.417	.628
		.31	.549	.631
		.31	.551	.632
		.36	.616	.633
		.41	.626	.641
		.46	.629	.661
		.52	.631	.667
		.62	.638	.671
		1.10	.660	.680
		1.21	.665	.682
		1.26	.665	.684
		1.31	.666	.684
		1.31	.667	.685
		1.36	.668	.685
		1.41	.669	.685
		1.46	.670	.686
		1.52	.672	.687
		1.62	.674	.688
158	-15	0.05	0.220	0.472
		.10	.313	.633
		.15	.289	.639
		.21	.283	.640
		.26	.268	.641
		.31	.311	.648
		.36	.427	.651
		.41	.542	.655
		.46	.576	.645
		.52	.583	.651
		.57	.589	.652
		1.05	.631	.680
		1.10	.632	.680
		1.15	.636	.681
		1.21	.640	.682
		1.26	.642	.684
		1.31	.644	.683
		1.36	.645	.683
		1.41	.647	.683
		1.46	.649	.685
		1.52	.641	.685
		1.57	.654	.687

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t	
			∅, deg	
			138	178
158	0	0.06	0.276	0.270
		.16	.418	.441
		.31	.649	.649
		.37	.703	.703
		.46	.712	.707
		1.06	.712	.712
		1.16	.711	.709
		1.31	.710	.710
		1.37	.711	.710
		1.46	.709	.709
158	4	0.06	0.324	0.336
		.21	.631	.668
		.26	.689	.710
		.31	.700	.712
		.36	.701	.712
		1.06	.710	.711
		1.21	.707	.713
		1.26	.707	.711
		1.31	.707	.710
		1.36	.707	.712
158	8	0.06	0.356	0.389
		.16	.583	.668
		.21	.672	.728
		.26	.681	.729
		1.06	.708	.723
		1.16	.707	.724
		1.21	.708	.723
		1.26	.710	.722
158	15	0.06	0.404	0.477
		.06	.403	.476
		.11	.367	.500
		.11	.366	.498
		.21	.666	.779
		.26	.673	.779
		1.06	.735	.763
		1.06	.735	.764
		1.11	.737	.763
		1.11	.737	.764
		1.21	.735	.761
		1.26	.737	.759
158	-4	0.06	0.215	0.234
		.21	.363	.407
		.36	.570	.527
		.46	.686	.592
		.56	.708	.655
		.66	.710	.707
		1.06	.711	.715
		1.21	.710	.715
		1.36	.710	.712
		1.46	.710	.712
		1.56	.711	.710
		1.66	.711	.713

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

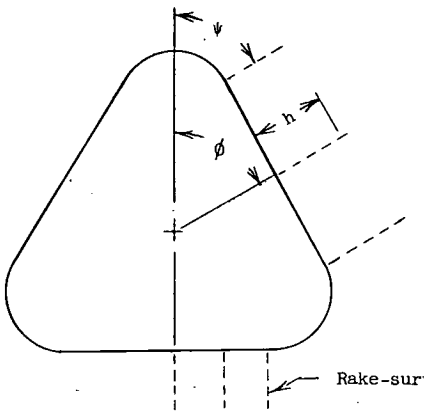
(f) 45° teardrop cross-section fuselage - Concluded

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t	
			∅, deg	
			138	178
158	-8	0.06	0.173	0.501
		.11	.197	.582
		.31	.241	.626
		.51	.477	.680
		.71	.689	.708
		1.06	.704	.714
		1.11	.705	.713
		1.31	.707	.713
		1.51	.707	.712
		1.71	.708	.715
158	-12	0.06	0.181	0.573
		.11	.271	.679
		.31	.383	.695
		.51	.354	.694
		.71	.323	.697
		1.06	.644	.706
		1.11	.650	.705
		1.31	.666	.707
		1.51	.678	.711
		1.71	.685	.710
158	-15	0.06	0.172	0.740
		.11	.283	.662
		.31	.311	.650
		.51	.284	.646
		.71	.270	.642
		1.06	.292	.671
		1.11	.304	.674

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(g) Triangle cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			20	61	101
60	0	0.06	0.271	0.321	0.284
		.16	.606	.540	.630
		.22	.672	.638	.681
		.27	.672	.666	.683
		.32	.671	.670	.685
		1.06	.689	.686	.683
		1.16	.688	.690	.688
		1.22	.688	.694	.689
		1.27	.691	.698	.691
		1.32	.694	.700	.693
60	8	0.06	0.259	0.355	0.234
		.16	.489	.570	.557
		.22	.592	.634	.604
		.27	.631	.637	.608
		.32	.631	.637	.612
		1.06	.653	.650	.660
		1.16	.653	.658	.663
		1.22	.656	.663	.666
		1.27	.658	.666	.668
		1.32	.662	.668	.670
60	12	0.06	0.238	0.418	0.160
		.16	.483	.568	.178
		.22	.581	.595	.275
		.27	.608	.601	.421
		.32	.609	.601	.454
		.42	.608	.601	.483
		.53	.609	.596	.509
		.63	.613	.577	.528
		1.06	.635	.615	.611
		1.16	.636	.623	.618
		1.22	.637	.626	.622
		1.27	.639	.628	.625
		1.32	.642	.631	.627
		1.42	.648	.634	.633
		1.53	.650	.638	.639
		1.63	.655	.641	.642

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			20	61	101
60	0	0.05	0.241	0.306	0.272
		.20	.525	.464	.580
		.30	.681	.624	.698
		.35	.703	.683	.699
		.40	.704	.698	.700
		1.05	.706	.705	.705
		1.20	.705	.705	.706
		1.30	.706	.706	.707
		1.35	.705	.704	.705
		1.40	.705	.704	.705
60	4	0.05	0.212	0.315	0.224
		.25	.508	.616	.636
		.30	.571	.671	.665
		.40	.689	.692	.672
		.50	.702	.692	.674
		1.05	.705	.699	.696
		1.25	.705	.700	.697
		1.30	.704	.700	.697
		1.40	.704	.700	.697
		1.50	.704	.699	.697
60	8	0.05	0.213	0.377	0.145
		.25	.520	.622	.559
		.30	.586	.654	.582
		.35	.667	.667	.588
		.40	.693	.668	.592
		.50	.695	.666	.598
		1.05	.703	.680	.652
		1.25	.702	.681	.657
		1.30	.702	.680	.658
		1.35	.701	.681	.658
		1.40	.701	.681	.660
		1.50	.701	.682	.660

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(g) Triangle cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			20	61	101
60	15	0.06	0.244	0.637	0.131
		.11	.399	.591	.183
		.16	.489	.599	.182
		.22	.553	.596	.136
		.27	.580	.592	.182
		.32	.588	.586	.314
		.37	.589	.586	.362
		.42	.587	.586	.377
		.48	.587	.535	.393
		.58	.588	.547	.444
		.63	.590	.555	.454
		1.06	.618	.580	.560
		1.11	.620	.583	.565
		1.16	.621	.586	.578
		1.22	.621	.587	.574
		1.27	.622	.590	.579
		1.32	.626	.592	.583
		1.37	.629	.594	.587
		1.42	.631	.596	.590
		1.48	.633	.599	.594
		1.58	.636	.603	.600
		1.63	.639	.605	.603
60	-8	0.06	0.302	0.405	0.260
		.11	.657	.575	.495
		.16	.716	.679	.610
		.22	.717	.693	.637
		.27	.715	.694	.643
		1.06	.731	.709	.678
		1.11	.731	.711	.683
		1.16	.730	.713	.688
		1.22	.731	.715	.693
		1.27	.732	.718	.698
60	-15	0.06	0.351	0.470	0.307
		.11	.747	.646	.490
		.16	.767	.735	.619
		.22	.769	.736	.637
		.27	.766	.737	.645
		1.06	.780	.746	.699
		1.11	.781	.748	.701
		1.16	.782	.750	.703
		1.22	.781	.754	.707
		1.27	.780	.755	.711

			141	156	180
180	0	0.05	0.402	0.330	0.371
		.13	.628	.572	.558
		.15	.671	.613	.595
		.20	.691	.681	.665
		.26	.693	.688	.685
		.41	.694	.691	.689
180	8	0.05	0.531	0.424	0.524
		.10	.696	.644	.671
		.15	.727	.733	.731
		.20	.728	.738	.734
		.41	.734	.742	.739

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			20	61	101
60	12	0.05	0.225	0.621	0.154
		.20	.475	.500	.217
		.30	.610	.410	.217
		.40	.672	.445	.416
		.50	.682	.539	.456
		.60	.681	.586	.471
		1.05	.693	.620	.573
		1.20	.690	.626	.582
		1.30	.689	.628	.587
		1.40	.689	.632	.594
		1.50	.689	.634	.600
		1.60	.688	.636	.605
60	15	0.05	0.339	0.482	0.254
		.10	.491	.448	.363
		.15	.755	.624	.488
		.20	.758	.719	.578
		.25	.757	.726	.610
		.30	.756	.726	.616
		.35	.759	.728	.627
		1.05	.757	.733	.682
		1.10	.758	.733	.683
		1.15	.757	.732	.685
		1.20	.757	.733	.686
		1.25	.756	.732	.687
		1.30	.756	.732	.688
		1.35	.755	.732	.690
60	-8	0.05	0.293	0.418	0.259
		.15	.654	.539	.512
		.20	.709	.646	.610
		.25	.713	.693	.655
		.30	.712	.695	.658
		.40	.712	.694	.664
		.50	.713	.694	.670
		1.05	.713	.698	.656
		1.15	.712	.697	.687
		1.20	.712	.698	.688
		1.25	.713	.698	.687
		1.30	.714	.699	.688
		1.40	.712	.700	.687
		1.50	.712	.699	.688
60	-15	0.05	0.238	0.370	0.154
		.20	.617	.306	.227
		.25	.682	.250	.205
		.40	.683	.162	.233
		.60	.681	.167	.413
		1.05	.678	.407	.523
		1.20	.674	.438	.532
		1.25	.673	.450	.536
		1.40	.672	.479	.546
		1.60	.671	.512	.558

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(g) Triangle cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			141	156	180
180	15	0.05	0.446	0.574	0.505
		.08	.664	.678	.678
		.10	.741	.756	.740
		.15	.787	.802	.799
		.20	.785	.798	.797
		.41	.788	.800	.797
180	-8	0.05	0.282	0.313	0.255
		.15	.349	.536	.447
		.26	.477	.678	.586
		.31	.554	.664	.638
		.36	.609	.668	.664
		.41	.640	.672	.669
		.46	.648	.669	.670
		.62	.655	.670	.656
180	-12	0.05	0.301	0.429	0.306
		.10	.493	.509	.437
		.20	.327	.613	.601
		.26	.280	.633	.621
		.31	.265	.637	.631
		.46	.298	.630	.648
		.67	.559	.619	.649
		.78	.583	.620	.633
180	-15	0.05	0.217	0.470	0.282
		.10	.458	.525	.382
		.15	.481	.580	.496
		.20	.476	.580	.571
		.26	.457	.579	.593
		.31	.431	.583	.599
		.41	.326	.571	.608
		.52	.264	.589	.598
		.62	.232	.558	.613
		.78	.244	.572	.597

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			141	156	180
180	0	0.11	0.430	0.405	0.374
		.21	.612	.575	.524
		.31	.701	.698	.665
		.36	.703	.705	.696
		.41	.462	.420	.298
		1.11	.708	.708	.707
		1.21	.708	.706	.708
		1.31	.708	.707	.707
		1.36	.708	.707	.707
		1.41	.710	.708	.710
180	8	0.11	0.578	0.553	0.551
		.16	.670	.650	.648
		.21	.706	.712	.709
		.26	.724	.727	.713
		.31	.714	.727	.726
		.41	.713	.726	.726
		1.11	.717	.722	.725
		1.16	.718	.724	.726
		1.21	.718	.723	.726
		1.26	.718	.724	.727
		1.31	.718	.724	.727
		1.41	.718	.724	.726
180	15	0.11	0.645	0.641	0.647
		.16	.743	.742	.747
		.21	.758	.775	.776
		.26	.761	.778	.779
		.31	.760	.778	.778
		1.11	.767	.779	.780
		1.16	.767	.777	.780
		1.21	.768	.778	.781
		1.26	.768	.779	.781
		1.31	.767	.778	.780
180	-4	0.11	0.462	0.420	0.298
		.26	.572	.646	.470
		.31	.615	.693	.537
		.36	.649	.706	.591
		.46	.693	.707	.690
		.56	.700	.706	.705
		1.11	.710	.708	.710
		1.26	.710	.707	.711
		1.31	.711	.709	.711
		1.36	.710	.709	.710
		1.46	.710	.708	.710
		1.56	.710	.708	.709
180	-8	0.11	0.614	0.434	0.357
		.31	.496	.684	.578
		.36	.463	.693	.621
		.41	.454	.697	.662
		.46	.460	.697	.687
		.51	.481	.696	.695
		1.11	.701	.705	.709
		1.31	.704	.706	.709
		1.36	.705	.705	.709
		1.41	.706	.706	.710
		1.46	.707	.706	.710
		1.51	.707	.706	.710

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

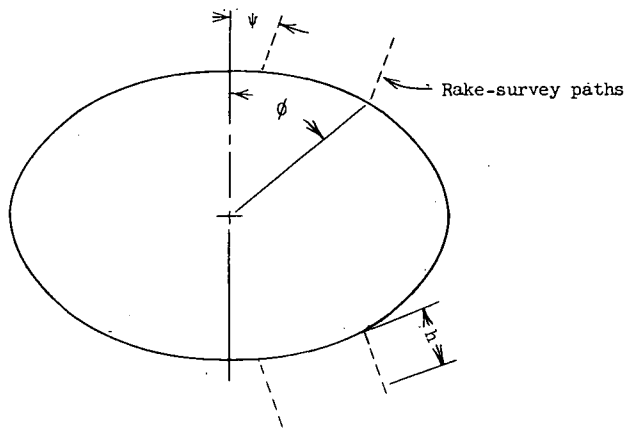
(g) Triangle cross-section fuselage - Concluded

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			141	156	180
180	-12	0.11	0.485	0.482	0.469
		.21	.588	.623	.609
		.26	.588	.631	.639
		.31	.586	.631	.646
		.51	.575	.632	.650
		.71	.469	.633	.656
		1.11	.329	.650	.667
		1.21	.372	.654	.669
		1.26	.404	.657	.671
		1.31	.431	.659	.673
		1.51	.503	.669	.682
		1.71	.595	.679	.689
180	-15	0.11	0.487	0.507	0.521
		.16	.546	.565	.584
		.21	.555	.578	.597
		.31	.549	.580	.600
		.51	.532	.572	.597
		.71	.499	.562	.593
		1.11	.226	.537	.596
		1.16	.215	.534	.594
		1.21	.209	.534	.597
		1.31	.207	.536	.602
		1.51	.238	.547	.615
		1.71	.321	.574	.632

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(h) Horizontal-ellipse cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t	
			ϕ, deg	
			12	50
20	0	0.05	0.285	0.343
		.10	.439	.515
		.15	.541	.633
		.20	.642	.680
		.25	.681	.683
		1.05	.682	.684
		1.10	.682	.683
		1.15	.682	.684
		1.20	.682	.684
		1.25	.682	.684
20	4	0.05	0.255	0.296
		.20	.545	.646
		.25	.627	.665
		.30	.671	.668
		.40	.672	.671
		1.05	.668	.669
		1.20	.669	.669
		1.25	.669	.670
		1.30	.669	.671
		1.40	.669	.671
20	8	0.05	0.252	0.239
		.20	.494	.568
		.25	.567	.627
		.30	.637	.638
		.40	.664	.644
		.58	.661	.648
		1.05	.660	.655
		1.20	.661	.656
		1.25	.663	.657
		1.30	.662	.657
		1.40	.663	.656
		1.58	.664	.660

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t	
			ϕ, deg	
			12	50
20	0	0.05	0.226	0.279
		.20	.499	.565
		.25	.583	.653
		.30	.655	.695
		.35	.697	.703
		1.05	.706	.704
		1.20	.707	.706
		1.25	.707	.707
		1.30	.707	.707
		1.35	.707	.706
20	4	0.05	0.201	0.233
		.20	.388	.450
		.35	.576	.659
		.45	.682	.693
		.50	.707	.695
		.55	.708	.698
		1.05	.711	.704
		1.20	.711	.705
		1.35	.712	.708
		1.45	.710	.707
		1.50	.709	.707
		1.55	.712	.708
20	8	0.05	0.235	0.228
		.20	.472	.337
		.25	.521	.318
		.30	.562	.326
		.40	.643	.453
		.45	.673	.540
		.55	.704	.639
		.61	.706	.653

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(h) Horizontal-ellipse cross-section fuselage - Concluded

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t	
			ϕ, deg	
			12	50
20	12	0.05	0.386	0.189
		.20	.512	.381
		.35	.639	.578
		.40	.652	.586
		.50	.652	.595
		1.05	.655	.631
		1.20	.655	.634
		1.35	.657	.637
		1.40	.658	.639
		1.50	.658	.641
20	15	0.05	0.462	0.238
		.25	.623	.164
		.30	.640	.139
		.40	.644	.201
		.58	.634	.465
		1.05	.650	.576
		1.25	.650	.595
		1.30	.652	.601
		1.40	.653	.608
		1.58	.654	.619

			130	168
160	8	0.05	0.404	0.334
		.10	.658	.629
		.15	.710	.723
		.20	.713	.735
		1.05	.724	.734
		1.10	.725	.736
		1.15	.725	.735
		1.20	.724	.735
160	15	0.05	0.489	0.428
		.10	.747	.780
		.15	.760	.796
		.20	.761	.797
		1.05	.779	.794
		1.10	.779	.794
		1.15	.779	.795
		1.20	.780	.795

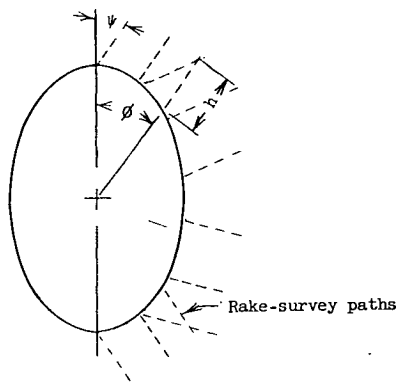
Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t	
			ϕ, deg	
			12	50
20	8	1.05	0.711	0.691
		1.20	.712	.697
		1.25	.713	.697
		1.30	.712	.698
		1.40	.713	.700
		1.45	.712	.700
		1.55	.712	.701
		1.61	.712	.702
20	12	0.05	0.280	0.248
		.20	.612	.419
		.35	.689	.397
		.40	.693	.320
		.50	.692	.241
		1.05	.701	.574
		1.20	.704	.617
		1.35	.706	.642
		1.40	.705	.648
		1.50	.705	.656
20	15	0.05	0.248	0.196
		.15	.588	.513
		.20	.625	.518
		.35	.632	.507
		.50	.633	.376
		1.05	.646	.105
		1.15	.649	.102
		1.20	.652	.100
		1.35	.657	.121
		1.50	.665	.205

			130	168
160	8	0.05	0.360	0.292
		.15	.668	.642
		.20	.705	.717
		.25	.705	.723
		.30	.704	.722
		1.05	.709	.721
		1.15	.711	.720
		1.20	.714	.723
		1.25	.713	.722
		1.30	.711	.721
160	15	0.05	0.422	0.360
		.15	.733	.749
		.20	.746	.779
		.25	.748	.779
		1.05	.757	.778
		1.15	.759	.779
		1.20	.760	.777
		1.25	.759	.778

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(i) Vertical-ellipse cross-section fuselage



Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	20	37
35	0	0.07	0.474	0.309	0.332
		.17	.675	.610	.582
		.22	.680	.673	.658
		.27	.682	.679	.672
		.32	.679	.676	.673
		.47	.684	.682	.672
		1.07	.678	.676	.679
		1.17	.685	.686	.686
		1.22	.685	.686	.687
		1.27	.686	.687	.688
		1.32	.686	.688	.688
		1.47	.686	.690	.690
35	4	0.07	0.376	0.277	0.295
		.17	.552	.475	.474
		.27	.667	.640	.629
		.32	.676	.667	.653
		.47	.677	.670	.653
		.57	.681	.674	.658
		1.07	.678	.675	.674
		1.17	.678	.676	.675
		1.27	.678	.677	.677
		1.32	.678	.677	.679
		1.47	.678	.678	.679
		1.57	.679	.680	.682
35	8	0.07	0.343	0.246	0.264
		.27	.493	.597	.607
		.32	.538	.645	.617
		.37	.575	.651	.617
		.47	.656	.652	.620
		.52	.676	.657	.629
		1.07	.681	.662	.656
		1.27	.677	.664	.661
		1.32	.677	.666	.662
		1.37	.676	.666	.662
		1.47	.675	.665	.663
		1.52	.676	.669	.667

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	20	37
35	0	0.09	0.381	0.350	0.324
		.24	.621	.625	.576
		.29	.686	.689	.651
		.34	.704	.707	.695
		.39	.703	.706	.700
		1.09	.705	.704	.706
		1.24	.704	.705	.706
		1.29	.705	.706	.707
		1.34	.706	.708	.708
		1.39	.705	.706	.707
35	4	0.09	0.311	0.271	0.294
		.24	.442	.442	.496
		.34	.531	.579	.642
		.44	.628	.689	.690
		.54	.697	.706	.693
		.64	.708	.707	.694
		.74	.707	.705	.693
		1.09	.710	.707	.705
		1.24	.711	.708	.708
		1.34	.707	.705	.705
		1.44	.707	.705	.705
		1.54	.708	.707	.707
		1.64	.709	.707	.707
		1.74	.708	.706	.706
35	8	0.09	0.478	0.193	0.262
		.29	.430	.361	.573
		.34	.424	.429	.633
		.39	.429	.512	.669
		.49	.472	.657	.675
		.59	.564	.688	.675
		.69	.659	.691	.677
		1.09	.708	.701	.698
		1.29	.710	.703	.701
		1.34	.709	.702	.700
		1.39	.711	.703	.702
		1.49	.710	.702	.701
		1.59	.710	.703	.701
		1.69	.710	.704	.702

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(i) Vertical-ellipse cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	20	37
35	12	0.07	0.433	0.188	0.251
		.17	.417	.351	.487
		.22	.420	.430	.541
		.27	.429	.549	.564
		.47	.594	.629	.578
		1.07	.676	.646	.629
		1.17	.680	.648	.634
		1.22	.674	.649	.635
		1.27	.670	.649	.636
		1.47	.672	.652	.641
35	15	0.07	0.504	0.177	0.233
		.17	.449	.249	.457
		.22	.415	.331	.517
		.27	.385	.444	.527
		.37	.378	.588	.537
		.47	.453	.599	.543
		.67	.656	.609	.568
		1.07	.672	.631	.603
		1.17	.672	.632	.606
		1.22	.674	.633	.608
		1.27	.674	.635	.610
		1.37	.668	.637	.614
		1.47	.668	.639	.618
		1.67	.668	.641	.626

ψ, deg	α, deg	h, in.	22	43	77
66	0	0.06	0.287	0.272	0.225
		.22	.660	.670	.622
		.27	.679	.679	.678
		.32	.681	.680	.685
		1.06	.681	.680	.678
		1.22	.682	.682	.681
		1.27	.681	.682	.681
		1.32	.682	.681	.681
66	8	0.06	0.211	0.242	0.220
		.16	.382	.512	.574
		.27	.551	.633	.654
		.32	.637	.636	.657
		.37	.657	.640	.654
		.42	.659	.645	.654
		1.06	.660	.655	.659
		1.16	.660	.656	.660
		1.27	.662	.659	.662
		1.32	.663	.660	.662
		1.37	.663	.660	.663
		1.42	.664	.661	.665

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			0	20	37
35	12	0.09	0.584	0.377	0.184
		.29	.420	.377	.471
		.39	.351	.295	.612
		.49	.326	.393	.634
		.69	.424	.646	.638
		1.09	.696	.674	.674
		1.29	.702	.681	.678
		1.39	.703	.683	.679
		1.49	.705	.685	.680
		1.69	.705	.689	.684
35	15	0.09	0.643	0.539	0.300
		.29	.450	.428	.230
		.49	.284	.323	.549
		.69	.288	.509	.583
		1.09	.642	.626	.641
		1.29	.674	.641	.647
		1.49	.684	.653	.653
		1.69	.690	.664	.660

ψ, deg	α, deg	h, in.	22	43	77
66	0	0.07	0.277	0.266	0.252
		.11	.350	.349	.345
		.15	.431	.427	.408
		.16	.440	.443	.428
		.22	.526	.538	.511
		.27	.608	.627	.594
		.32	.672	.687	.664
		.37	.695	.701	.699
		.42	.699	.701	.707
		1.07	.707	.706	.707
		1.11	.707	.706	.707
		1.15	.708	.706	.708
		1.16	.708	.707	.708
		1.22	.708	.706	.708
		1.27	.707	.706	.708
		1.32	.708	.707	.708
		1.37	.708	.707	.708
		1.42	.708	.706	.709
66	8	0.07	0.173	0.219	0.242
		.14	.214	.351	.453
		.22	.263	.488	.612
		.27	.320	.583	.667
		.32	.389	.661	.674
		.37	.468	.690	.675
		.42	.563	.691	.674
		.47	.637	.691	.673
		.53	.688	.693	.674
		.58	.696	.692	.676
		1.07	.701	.695	.686
		1.14	.702	.696	.687
		1.22	.703	.697	.688
		1.27	.703	.697	.687
		1.32	.702	.697	.687
		1.37	.703	.698	.689
		1.42	.703	.698	.689
		1.47	.702	.696	.688
		1.53	.703	.698	.689
		1.58	.702	.697	.689

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Continued

(i) Vertical-ellipse cross-section fuselage - Continued

Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			22	43	77
66	15	0.06	0.158	0.188	0.191
		.22	.272	.547	.562
		.32	.530	.559	.568
		.37	.611	.565	.569
		.42	.617	.574	.571
		1.06	.629	.601	.611
		1.22	.631	.606	.619
		1.32	.632	.612	.622
		1.37	.632	.613	.624
		1.42	.632	.614	.625

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			103	137	158
114	8	0.06	0.241	0.309	0.379
		.11	.467	.531	.468
		.16	.596	.643	.662
		.22	.638	.651	.680
		.27	.641	.657	.681
		1.06	.672	.684	.696
		1.11	.672	.683	.696
		1.16	.674	.686	.698
		1.22	.674	.685	.698
		1.27	.676	.686	.698
114	15	0.06	0.237	0.309	0.433
		.16	.531	.591	.677
		.22	.544	.602	.679
		.27	.549	.608	.681
		1.06	.640	.683	.716
		1.16	.644	.685	.716
		1.22	.647	.687	.717
		1.27	.649	.687	.717

Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			22	43	77
66	12	0.07	0.210	0.173	0.211
		.14	.294	.250	.457
		.22	.342	.462	.590
		.27	.311	.534	.599
		.32	.262	.632	.598
		.37	.291	.668	.599
		.42	.355	.670	.601
		.47	.461	.670	.604
		.53	.568	.671	.608
		.58	.652	.673	.613
		.63	.666	.671	.615
		1.07	.684	.676	.634
		1.14	.685	.676	.634
		1.22	.687	.678	.637
		1.27	.688	.678	.638
		1.32	.688	.680	.639
		1.37	.687	.679	.640
		1.42	.688	.679	.642
		1.47	.689	.680	.643
		1.53	.689	.680	.644
		1.58	.690	.680	.646
		1.63	.689	.680	.647
66	15	0.07	0.225	0.181	0.195
		.11	.295	.194	.352
		.16	.417	.185	.443
		.22	.470	.214	.491
		.27	.462	.299	.498
		.32	.447	.453	.502
		.32	.451	.447	.503
		.37	.414	.586	.509
		.42	.331	.635	.515
		.47	.296	.638	.524
		.53	.350	.639	.529
		.58	.458	.641	.534
		.63	.580	.643	.540
		1.07	.659	.651	.581
		1.11	.659	.652	.583
		1.16	.661	.653	.587
		1.22	.663	.654	.589
		1.27	.664	.655	.592
		1.32	.666	.657	.595
		1.32	.666	.657	.596
		1.37	.667	.658	.598
		1.42	.669	.659	.600
		1.47	.670	.660	.603
		1.53	.670	.660	.605
		1.58	.671	.662	.607
		1.63	.671	.660	.609

TABLE I.- TABULATED BOUNDARY-LAYER SURVEY DATA - Concluded

(i) Vertical-ellipse cross-section fuselage - Concluded

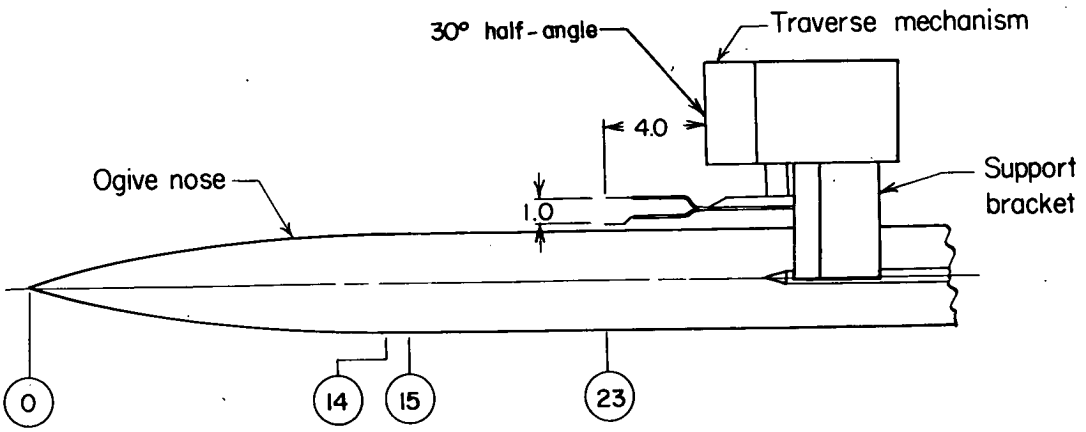
Station 15

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			143	160	180
145	8	0.07	0.300	0.337	0.665
		.12	.588	.659	.734
		.17	.677	.707	.721
		1.07	.707	.718	.720
		1.12	.709	.719	.720
		1.17	.711	.720	.720
145	15	0.07	0.331	0.412	0.544
		.12	.590	.626	.878
		.17	.689	.749	.778
		.27	.697	.749	.773
		1.07	.743	.763	.773
		1.12	.742	.762	.770
		1.17	.746	.763	.771
		1.27	.745	.763	.770

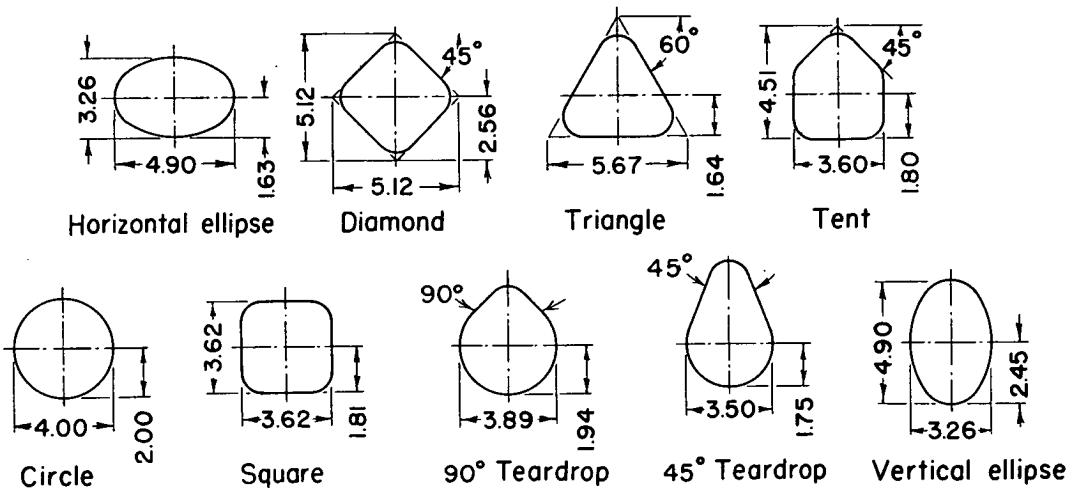
Station 23

ψ, deg	α, deg	h, in.	p_l'/p_t		
			ϕ, deg		
			103	137	158
114	8	0.07	0.272	0.301	0.367
		.16	.525	.568	.618
		.22	.625	.632	.672
		.27	.645	.636	.674
		.32	.647	.638	.675
		.53	.651	.641	.677
		1.07	.673	.686	.699
		1.16	.674	.685	.697
		1.22	.674	.686	.697
		1.27	.676	.687	.697
		1.32	.677	.688	.697
		1.53	.679	.688	.696
114	15	0.07	0.228	0.285	0.416
		.14	.441	.530	.640
		.16	.475	.548	.658
		.22	.496	.556	.660
		.27	.503	.561	.662
		.53	.529	.578	.672
		1.07	.613	.667	.710
		1.14	.617	.667	.708
		1.16	.618	.669	.708
		1.22	.621	.669	.708
		1.27	.623	.671	.708
		1.53	.635	.677	.707

			143	160	180
145	8	0.09	0.355	0.401	0.454
		.09	.320	.358	.414
		.11	.466	.573	.658
		.14	.568	.661	.736
		.19	.665	.707	.723
		.24	.689	.708	.722
		.29	.692	.710	.722
		1.09	.703	.712	.718
		1.09	.703	.712	.719
		1.11	.703	.712	.718
		1.14	.704	.714	.719
		1.19	.704	.714	.718
		1.24	.704	.714	.717
		1.29	.705	.714	.719
145	15	0.09	0.371	0.409	0.475
		.09	.374	.405	.473
		.11	.492	.554	.471
		.14	.624	.759	.867
		.19	.676	.741	.774
		.24	.680	.743	.772
		.29	.686	.746	.773
		1.09	.723	.747	.762
		1.09	.724	.748	.762
		1.11	.726	.749	.763
		1.14	.726	.749	.763
		1.19	.727	.749	.762
		1.24	.727	.748	.760
		1.29	.729	.749	.761

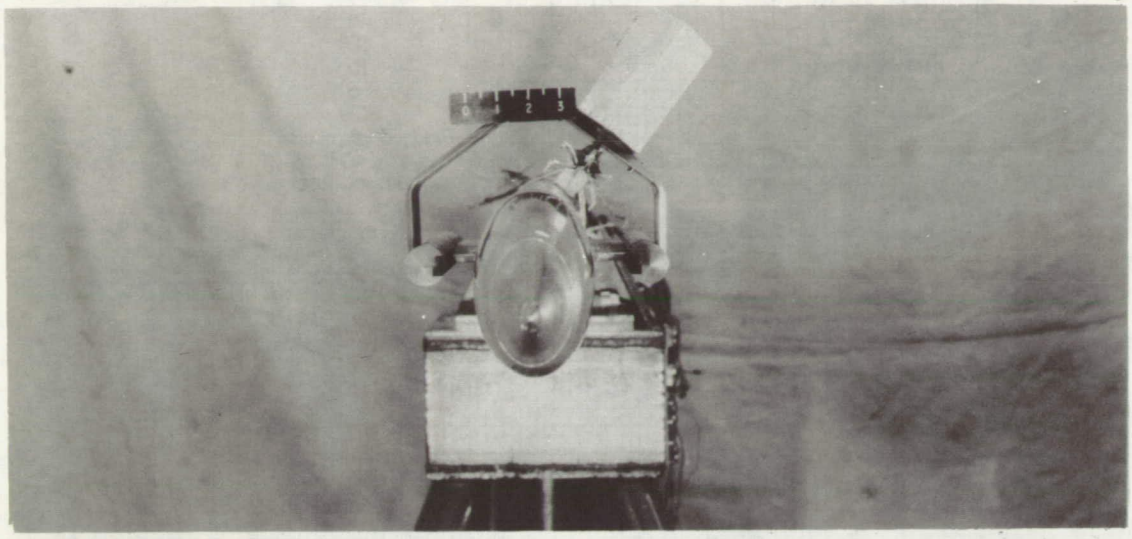


Model arrangement
Circular body shown

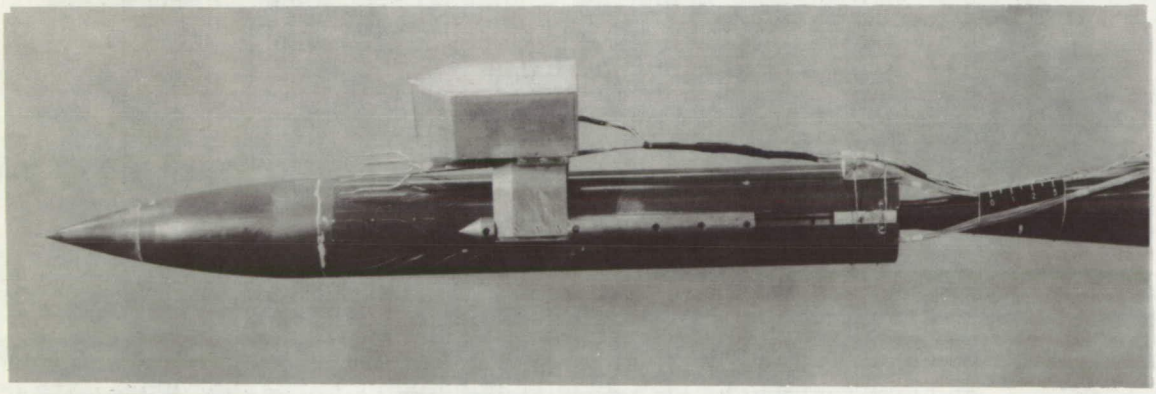


Body cross-sectional shapes
All radii .8 in. unless otherwise noted

Figure 1.- Sketch showing arrangement of model, boundary-layer survey equipment, and fuselage cross-sectional shapes. (All dimensions in inches unless otherwise noted.)

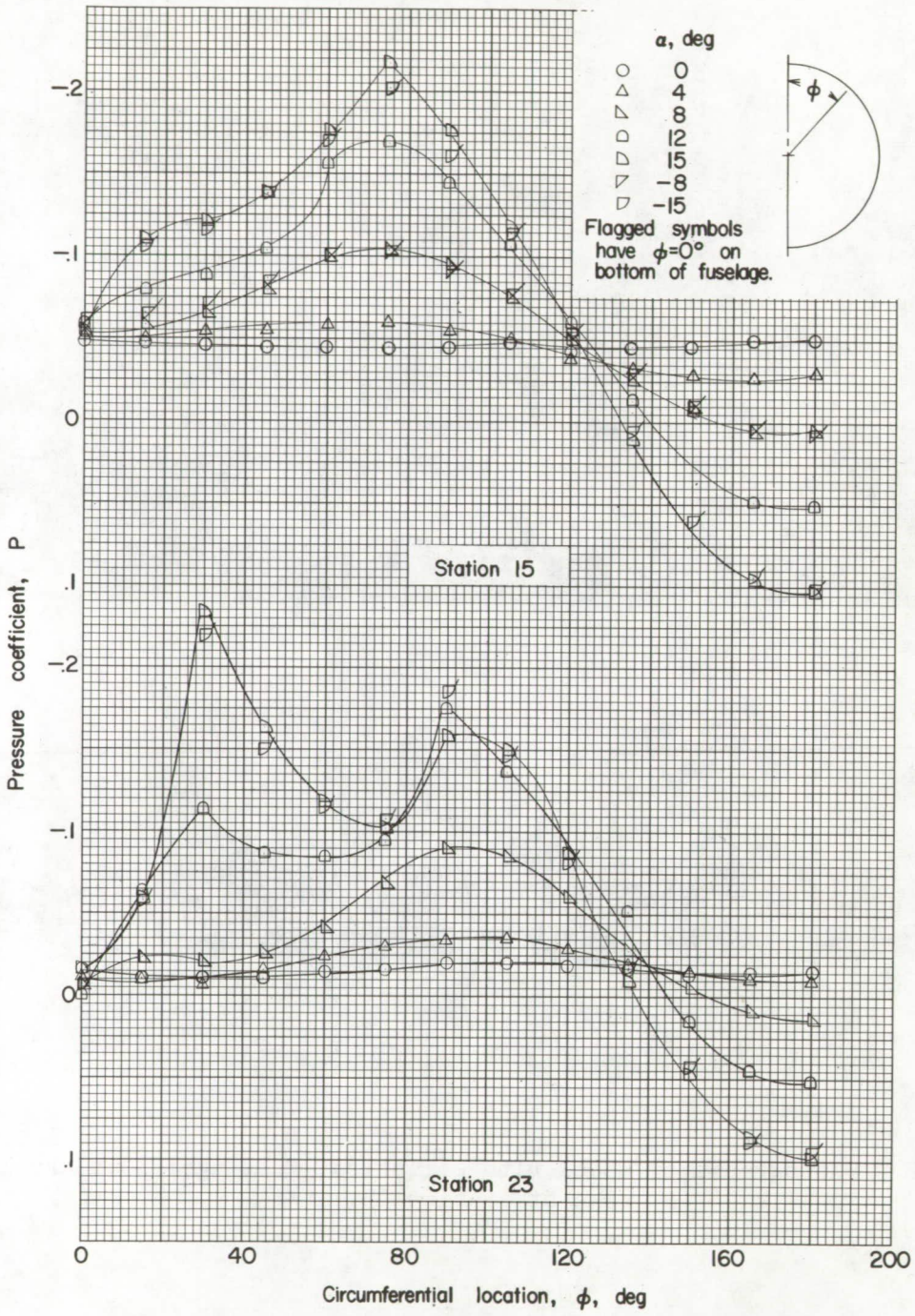


L-87609



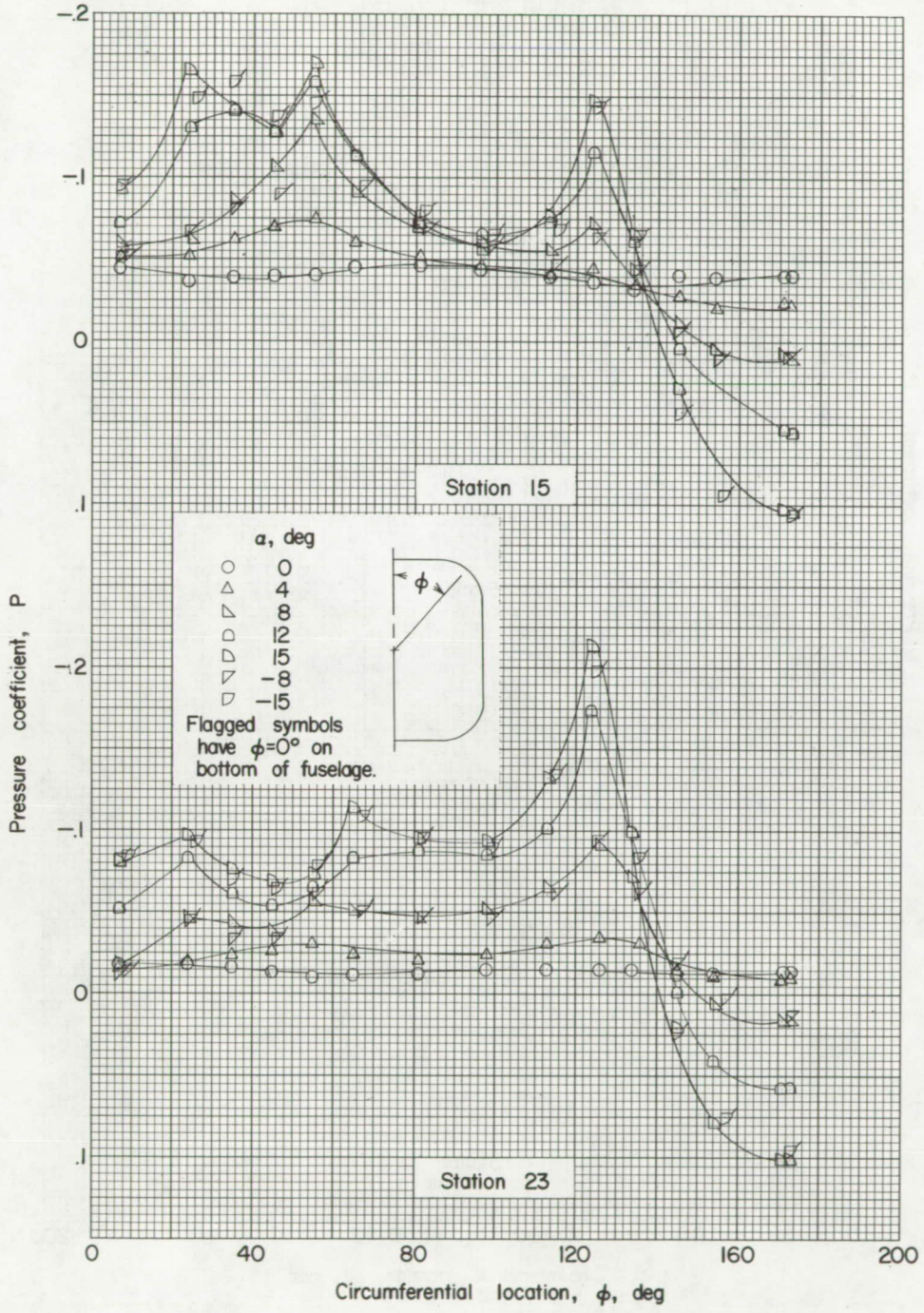
L-87607

Figure 2.- Photographs of model with elliptical fuselage; boundary-layer rake at station 15.



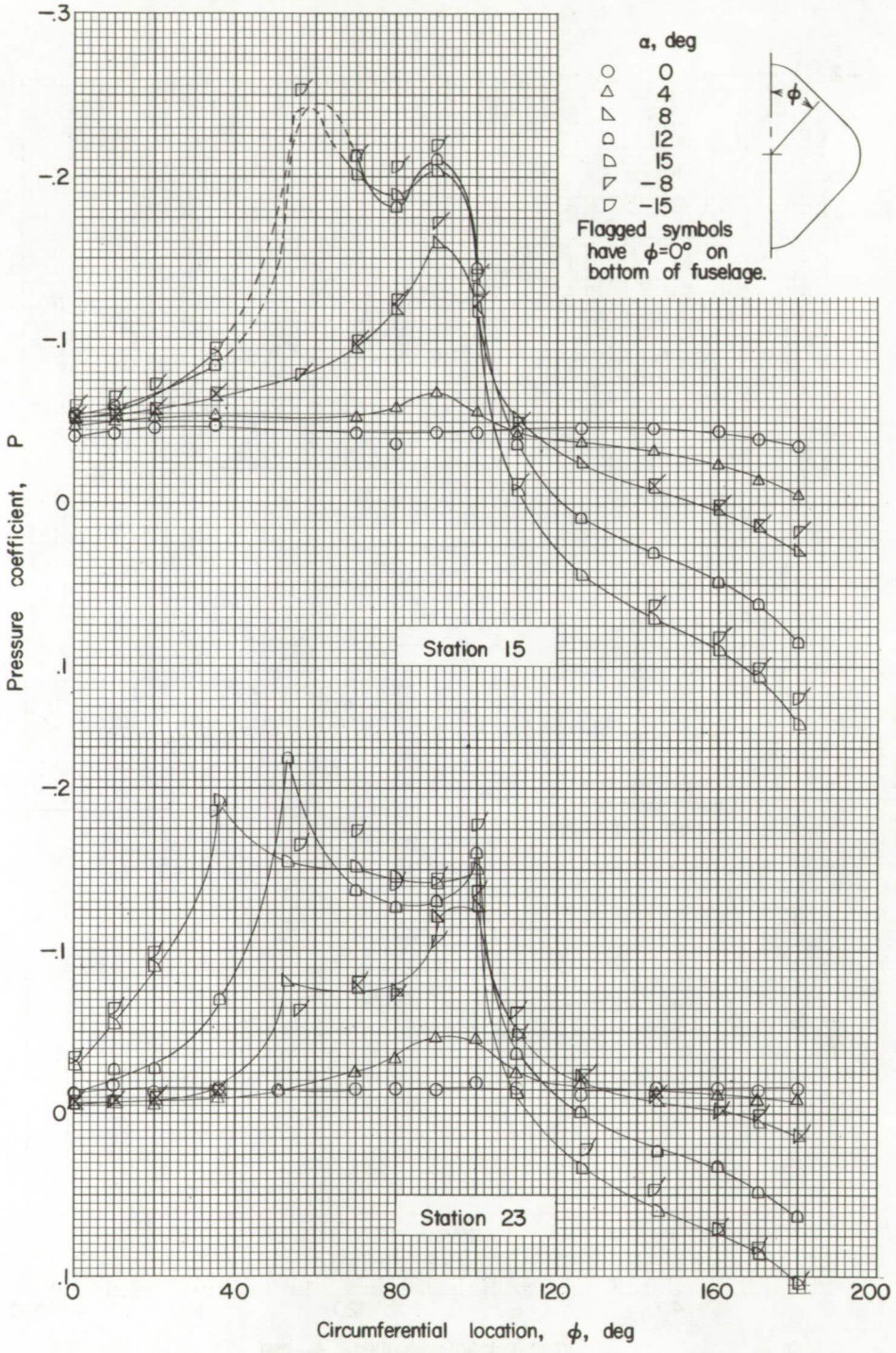
(a) Circular cross section.

Figure 3.- Static-pressure distributions on fuselages.



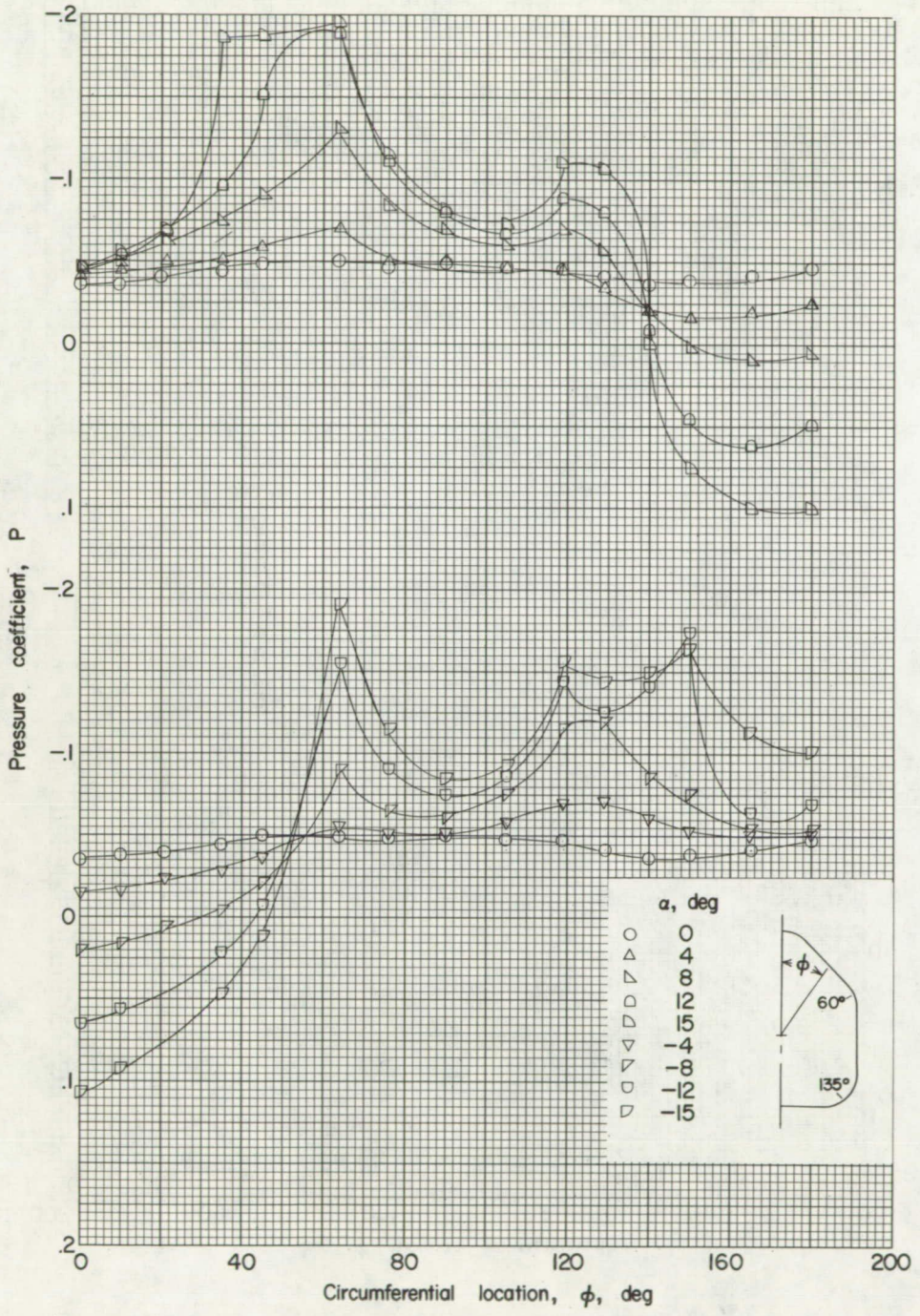
(b) Square cross section.

Figure 3.- Continued.



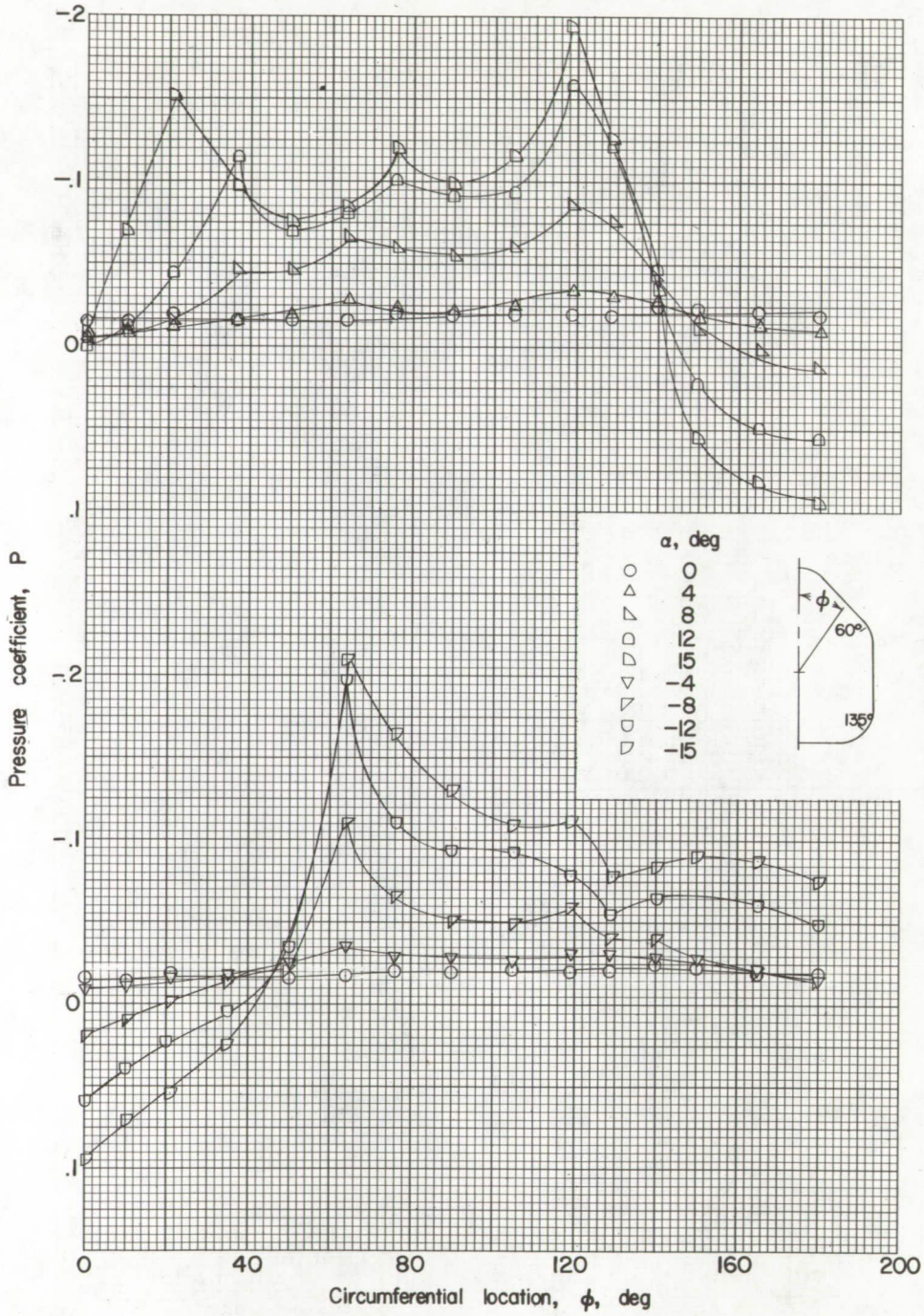
(c) Diamond cross section.

Figure 3.- Continued.



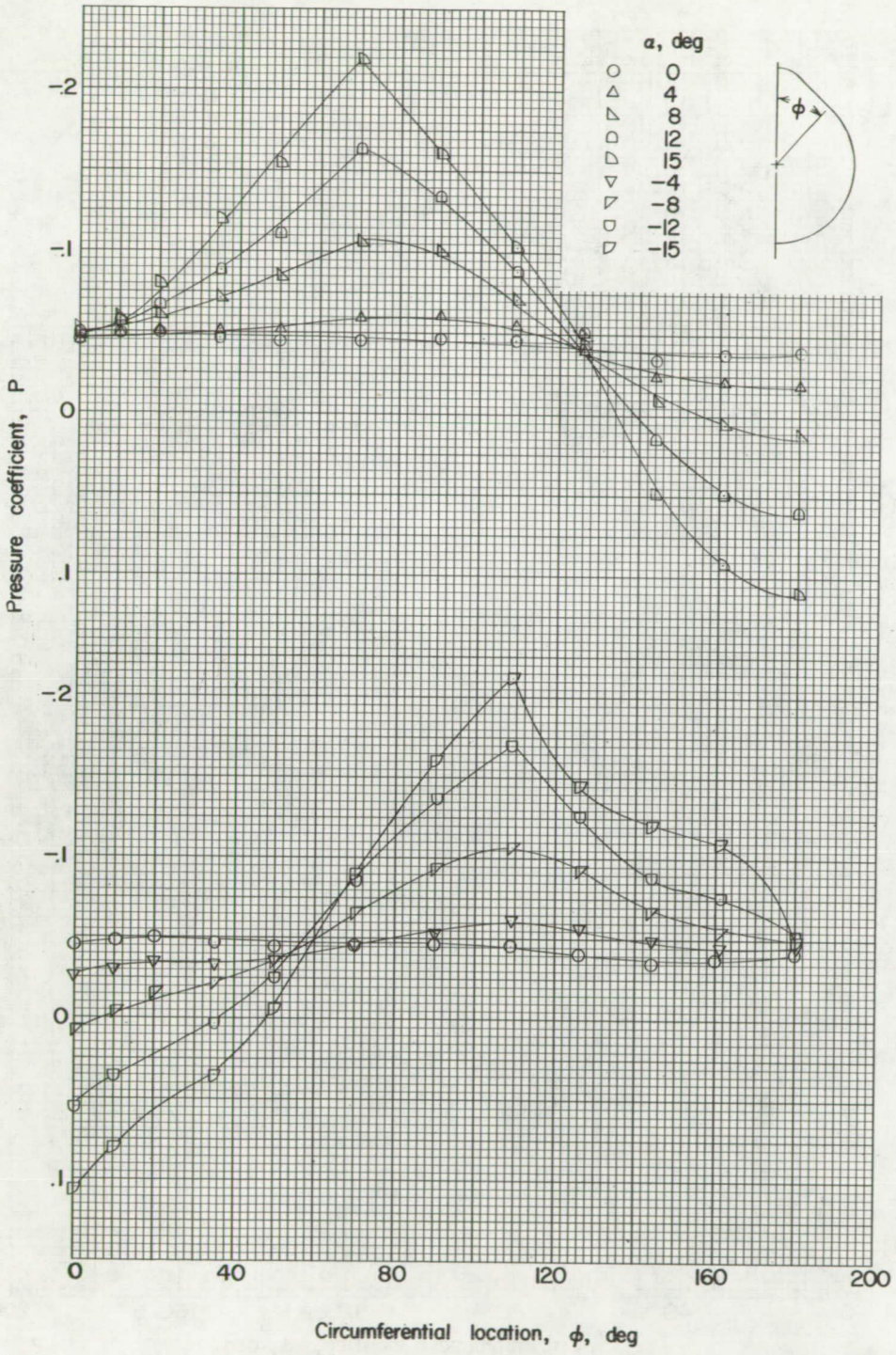
(d) Tent cross section; station 15.

Figure 3.- Continued.



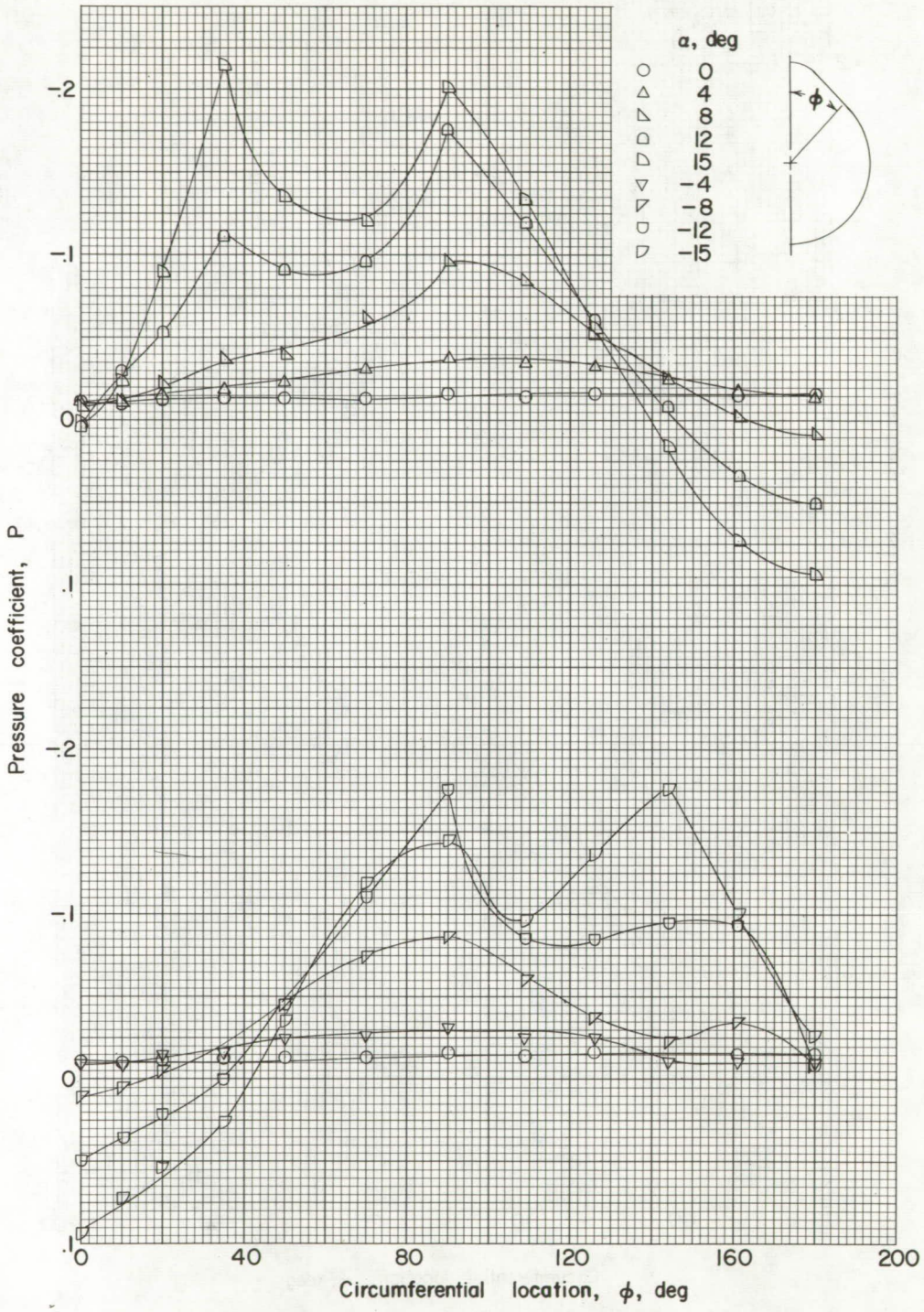
(e) Tent cross section; station 23.

Figure 3.- Continued.



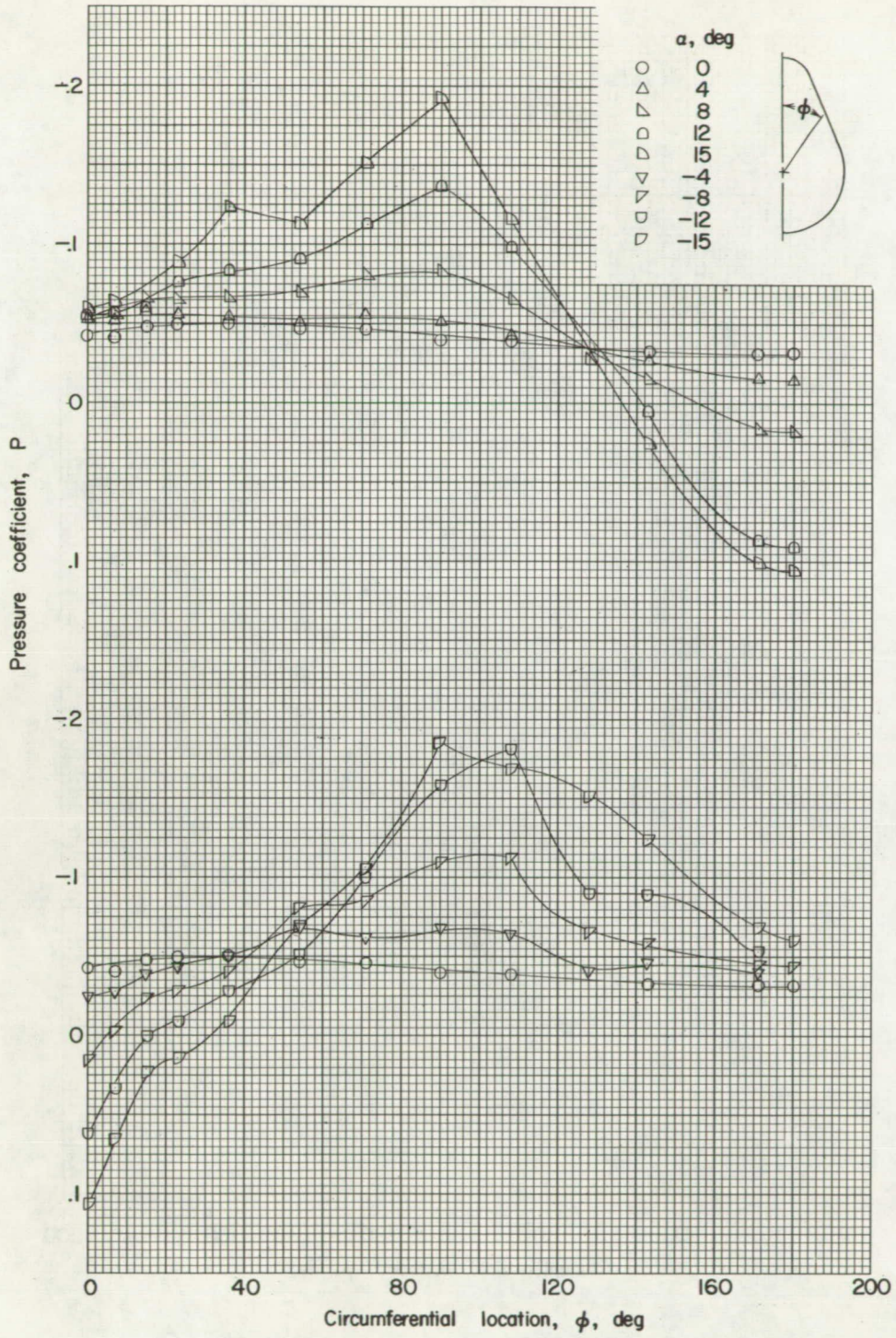
(f) 90° teardrop cross section; station 15.

Figure 3.- Continued.



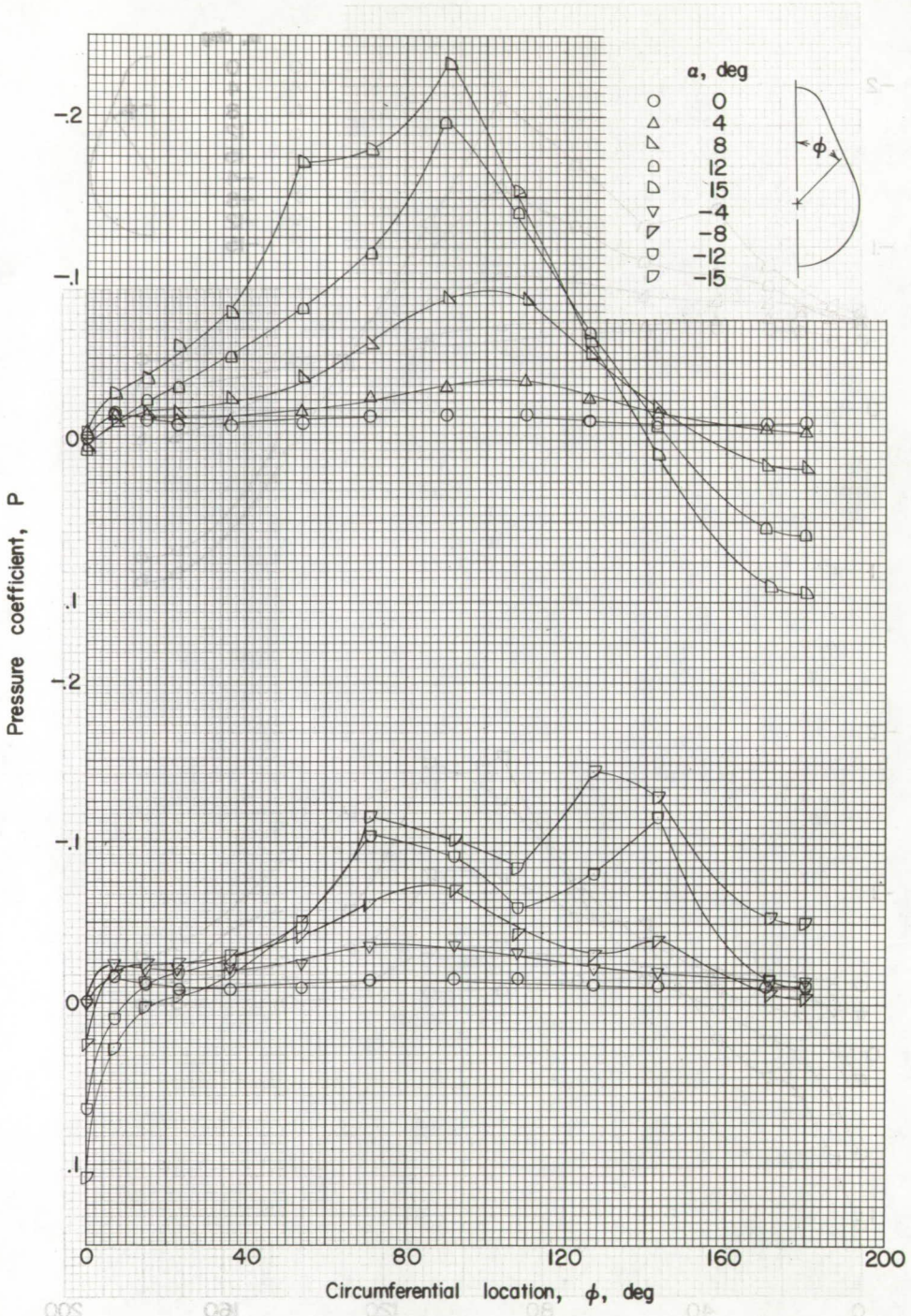
(g) 90° teardrop cross section; station 23.

Figure 3.- Continued.



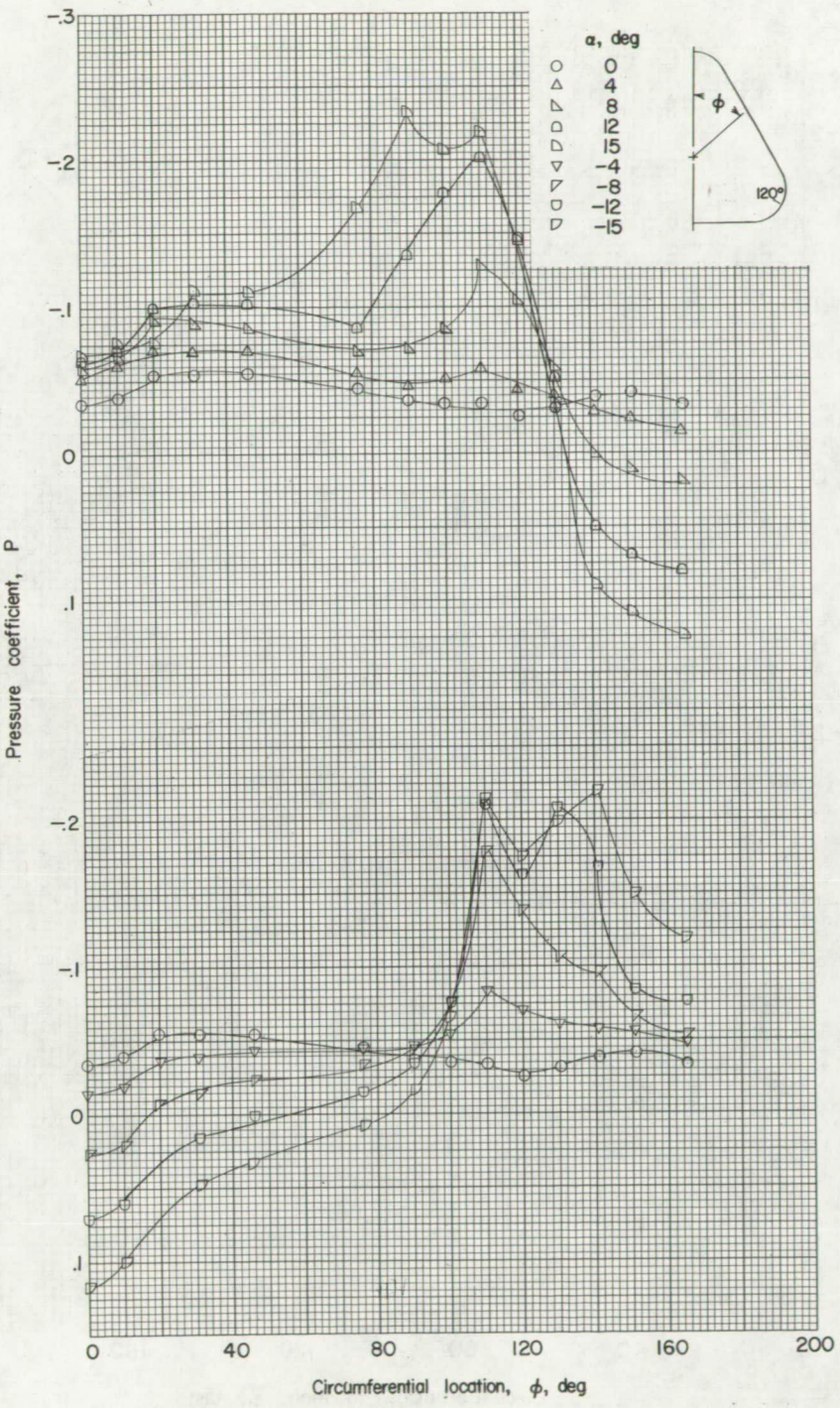
(h) 45° teardrop cross section; station 15.

Figure 3.- Continued.



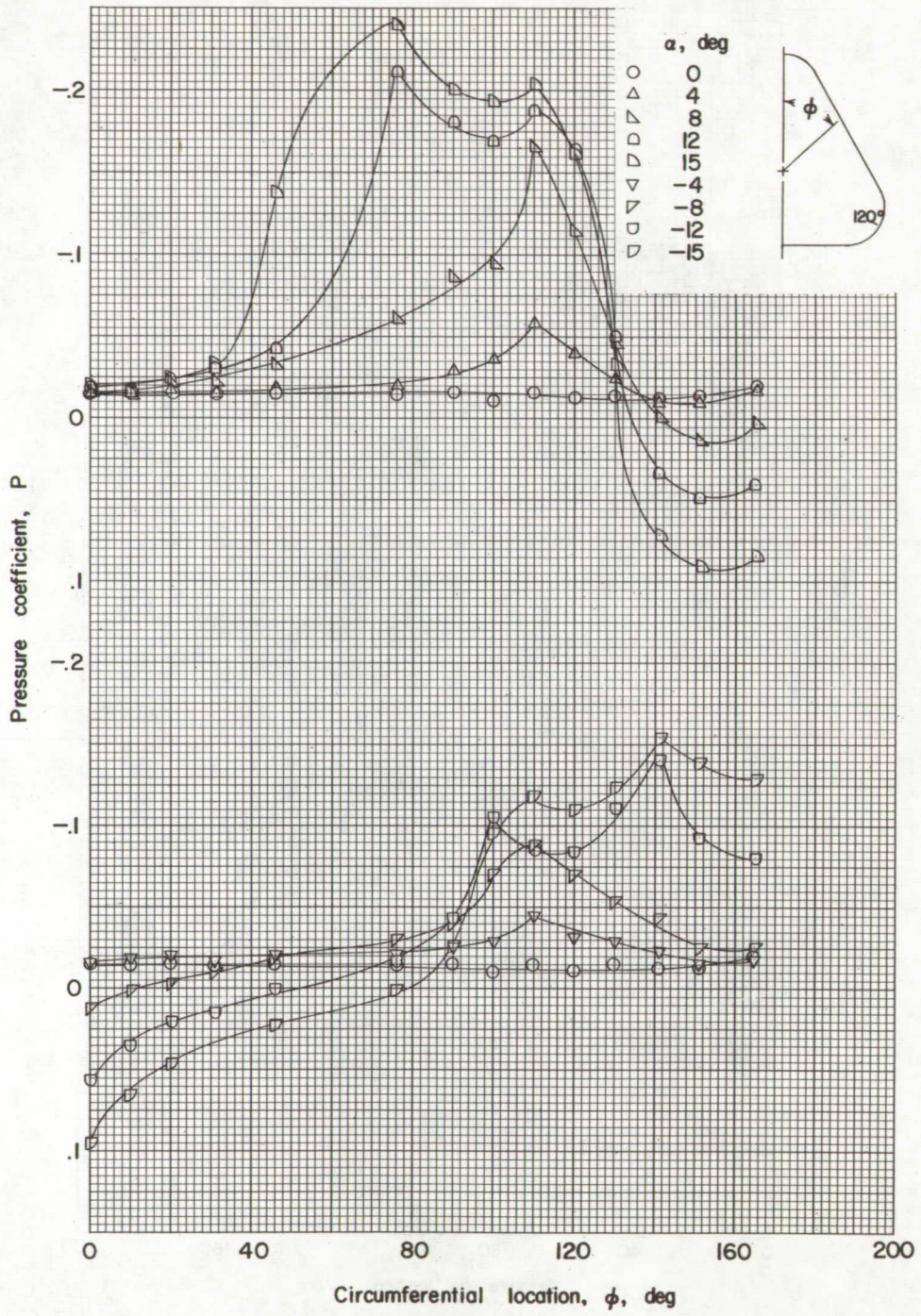
(i) 45° teardrop cross section; station 23.

Figure 3.- Continued.



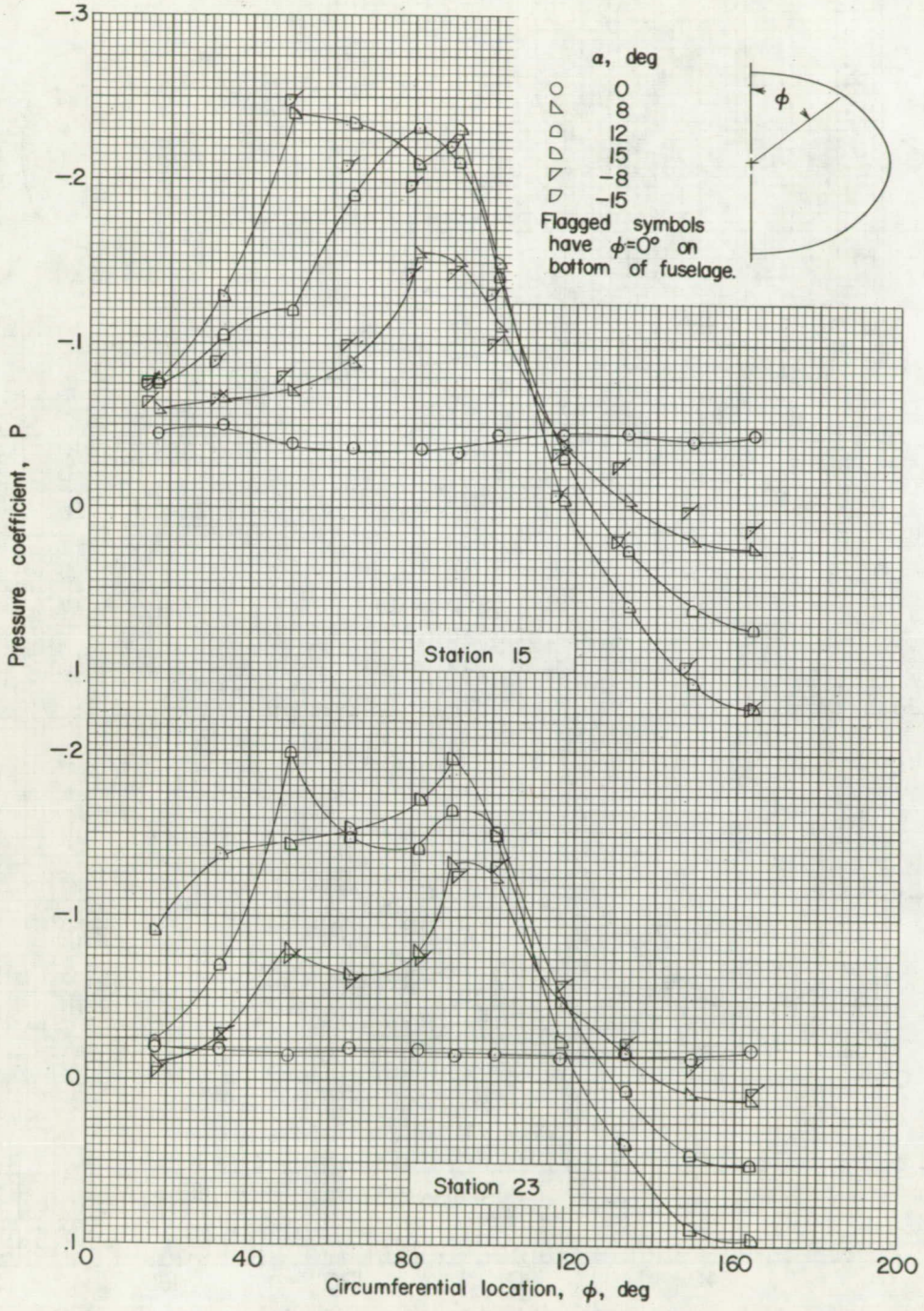
(j) Triangle cross section; station 15.

Figure 3.- Continued.



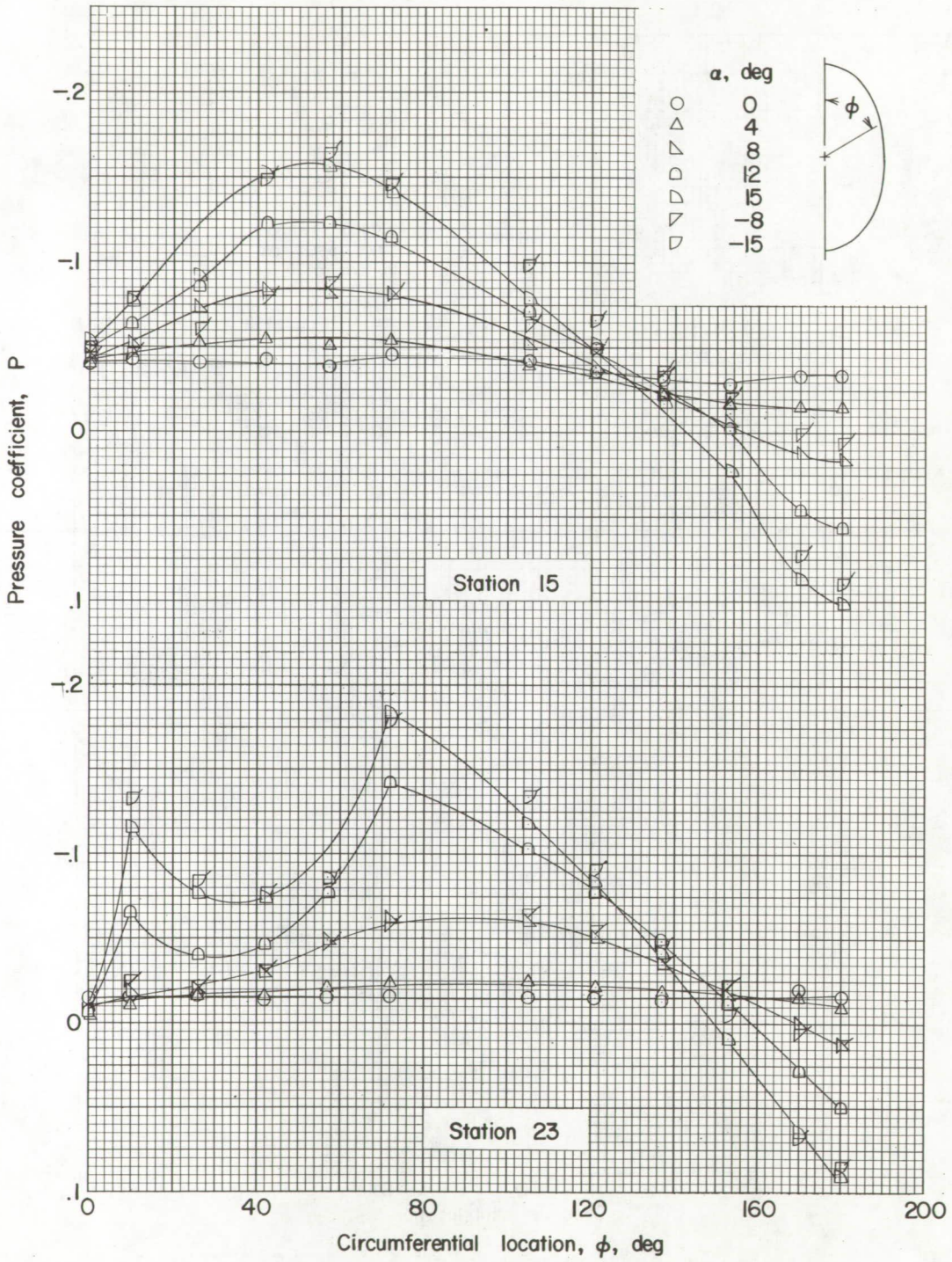
(k) Triangle cross section; station 23.

Figure 3.- Continued.



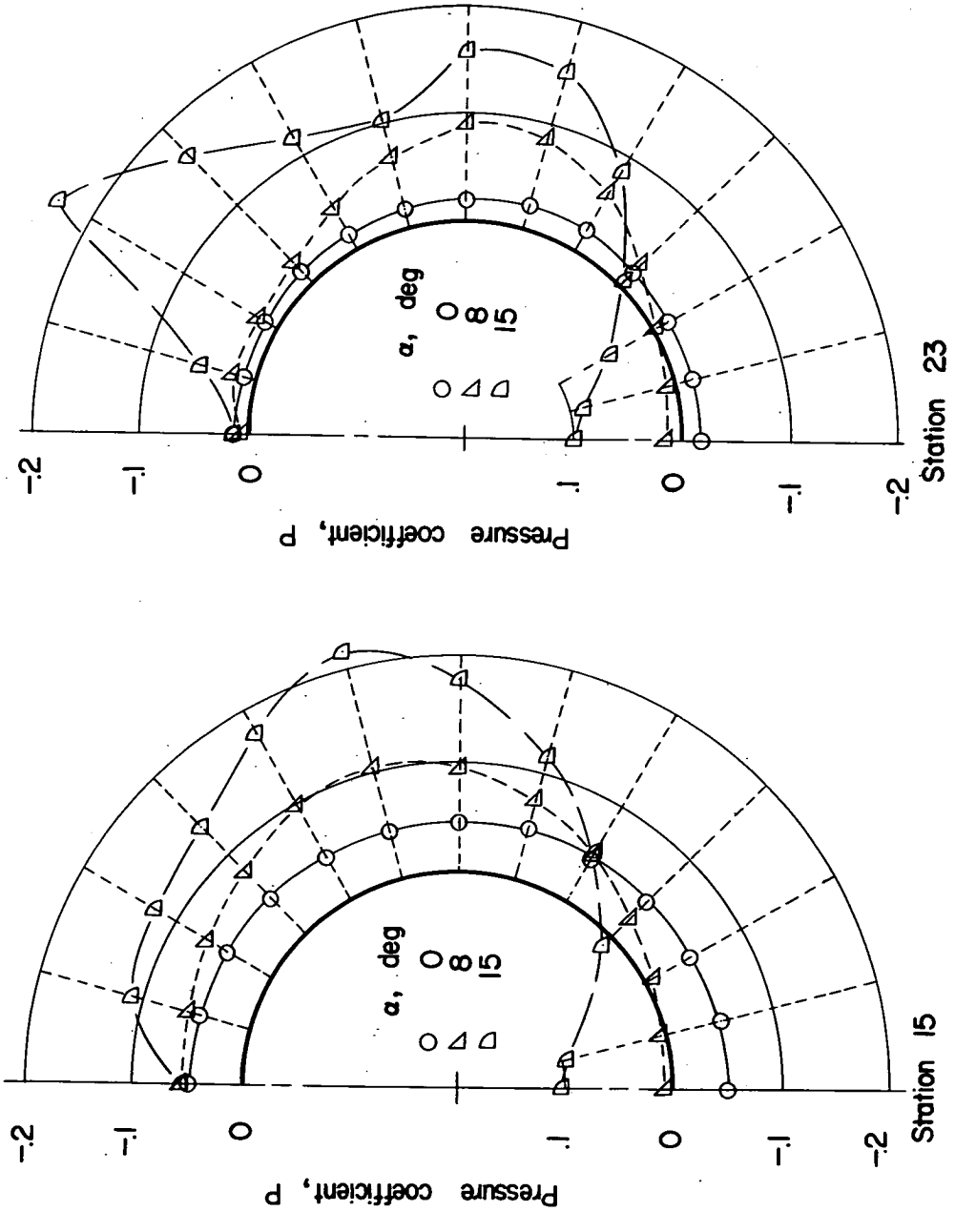
(l) Horizontal-ellipse cross section.

Figure 3.- Continued.



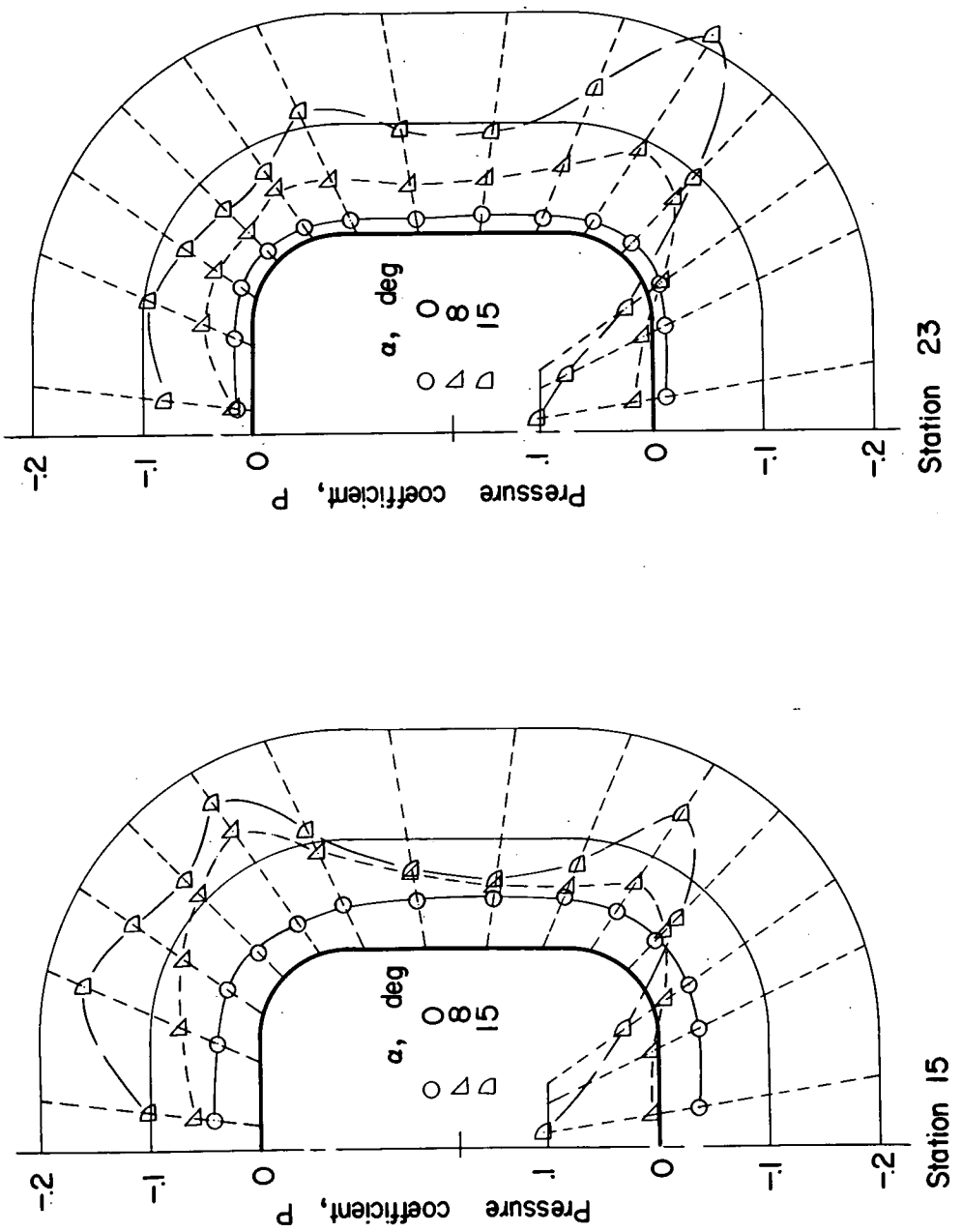
(m) Vertical-ellipse cross section.

Figure 3.- Concluded.



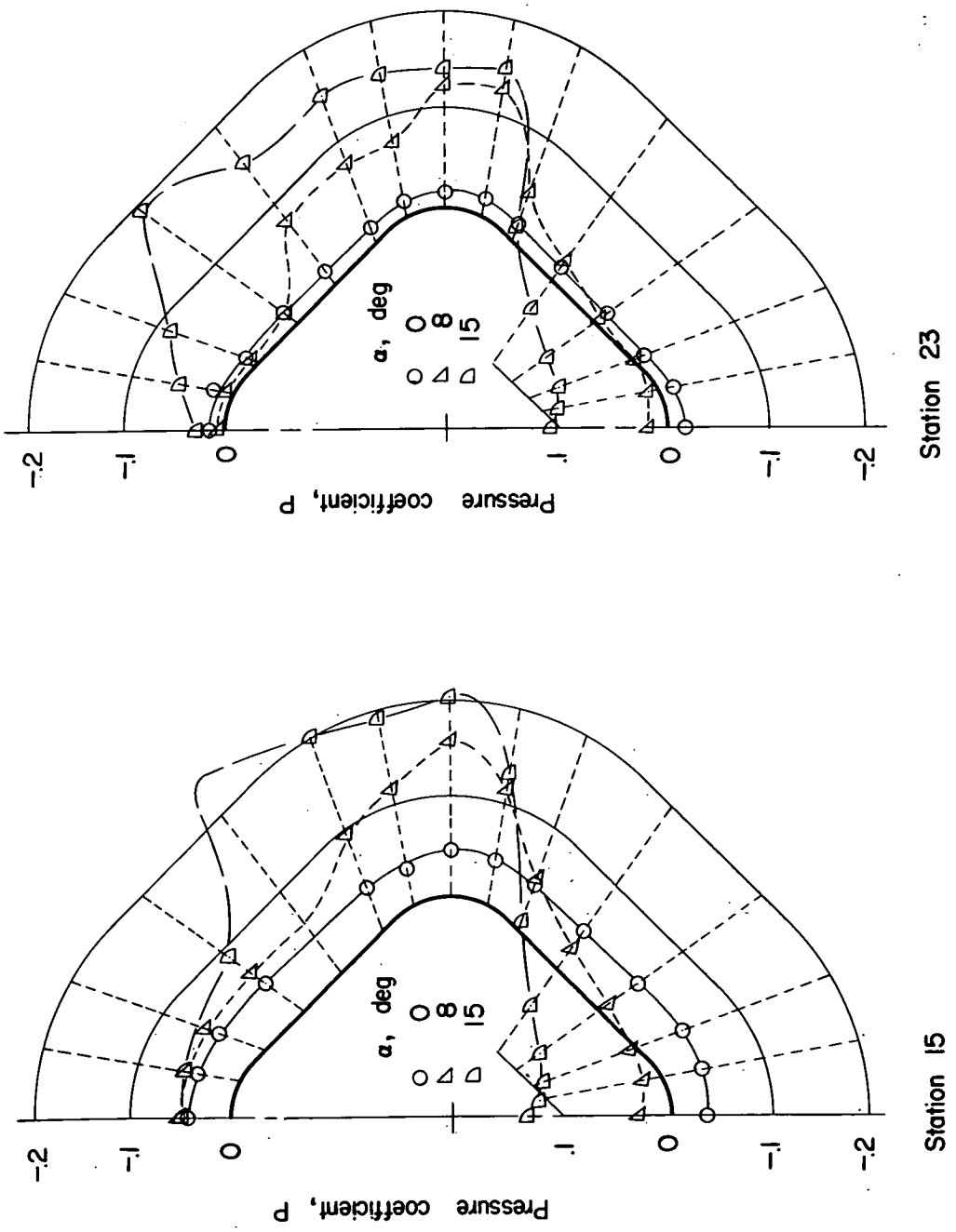
(a) Circular cross section.

Figure 4.- Static-pressure distributions on fuselages.



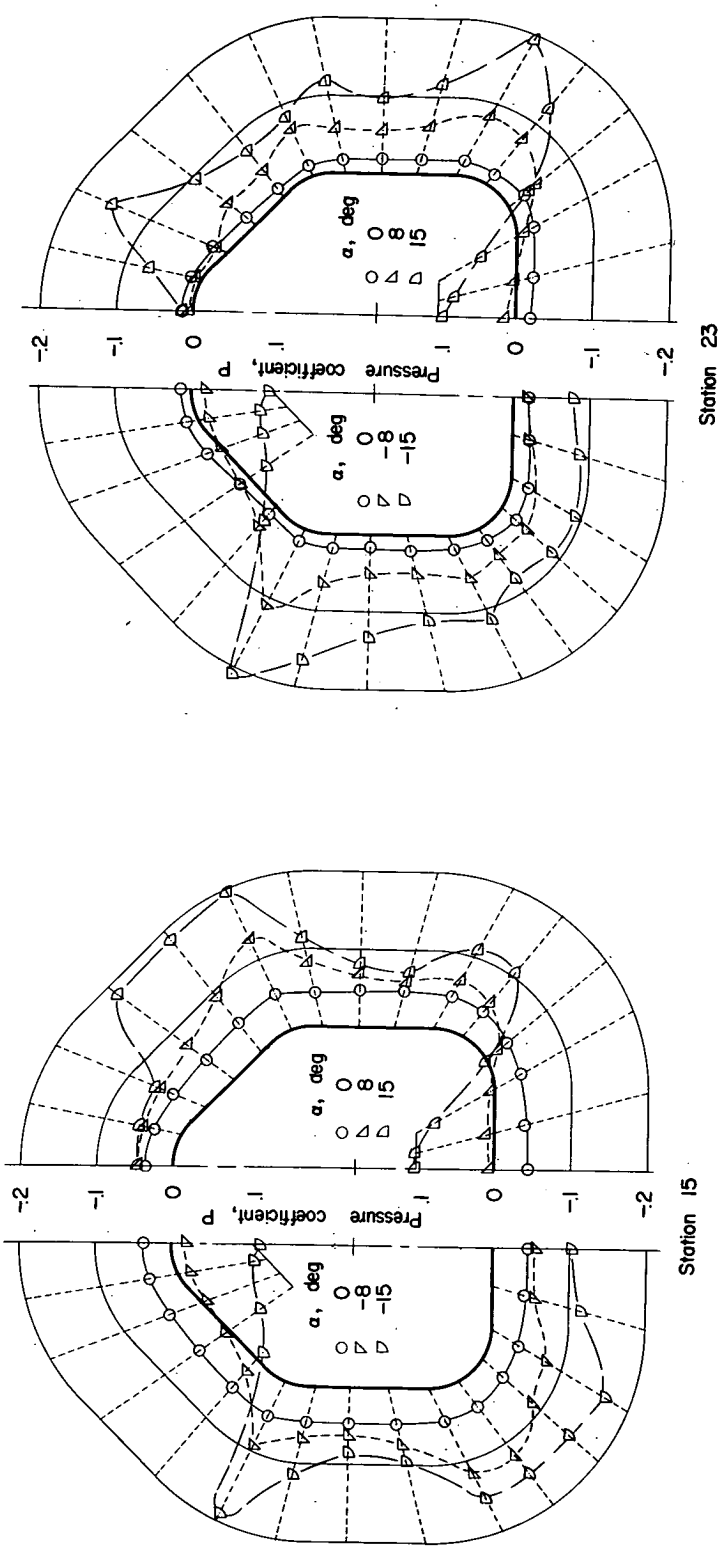
(b) Square cross section.

Figure 4.- Continued.



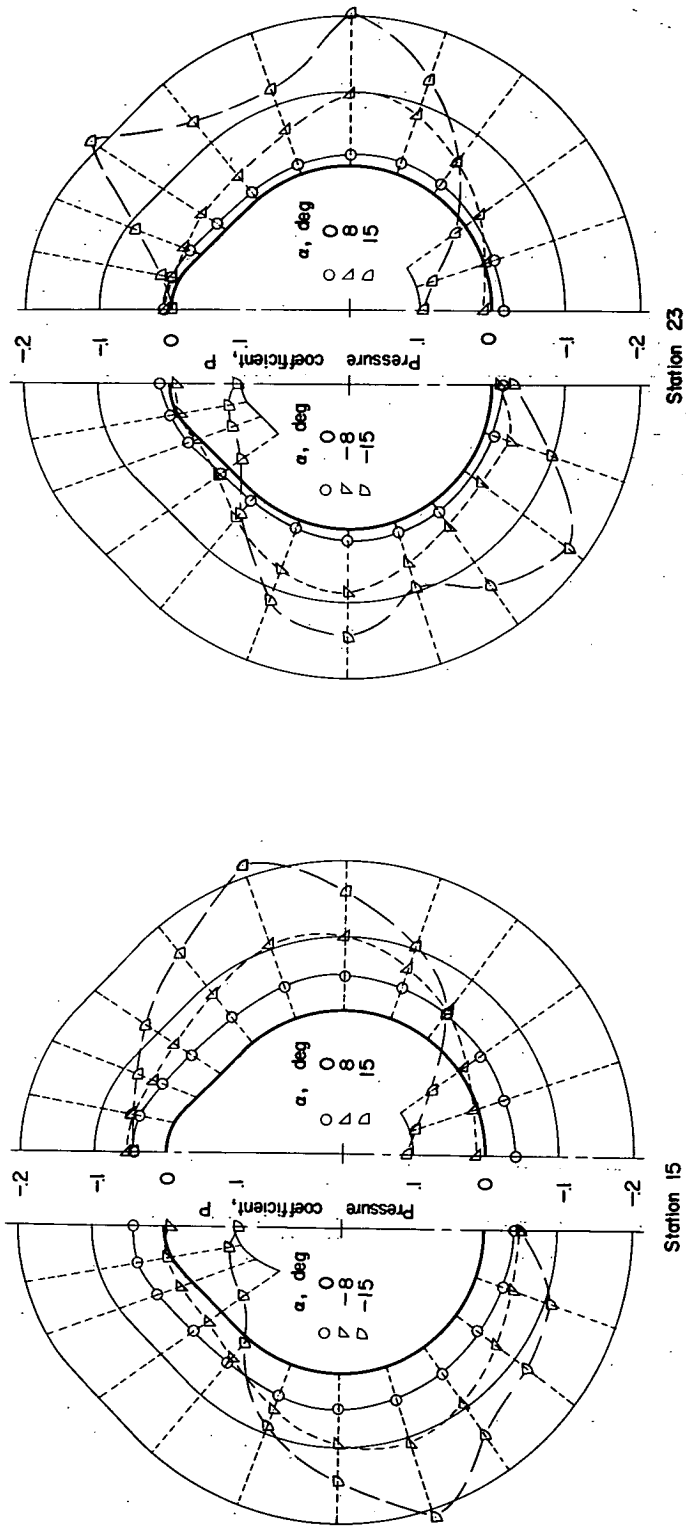
(c) Diamond cross section.

Figure 4.- Continued.



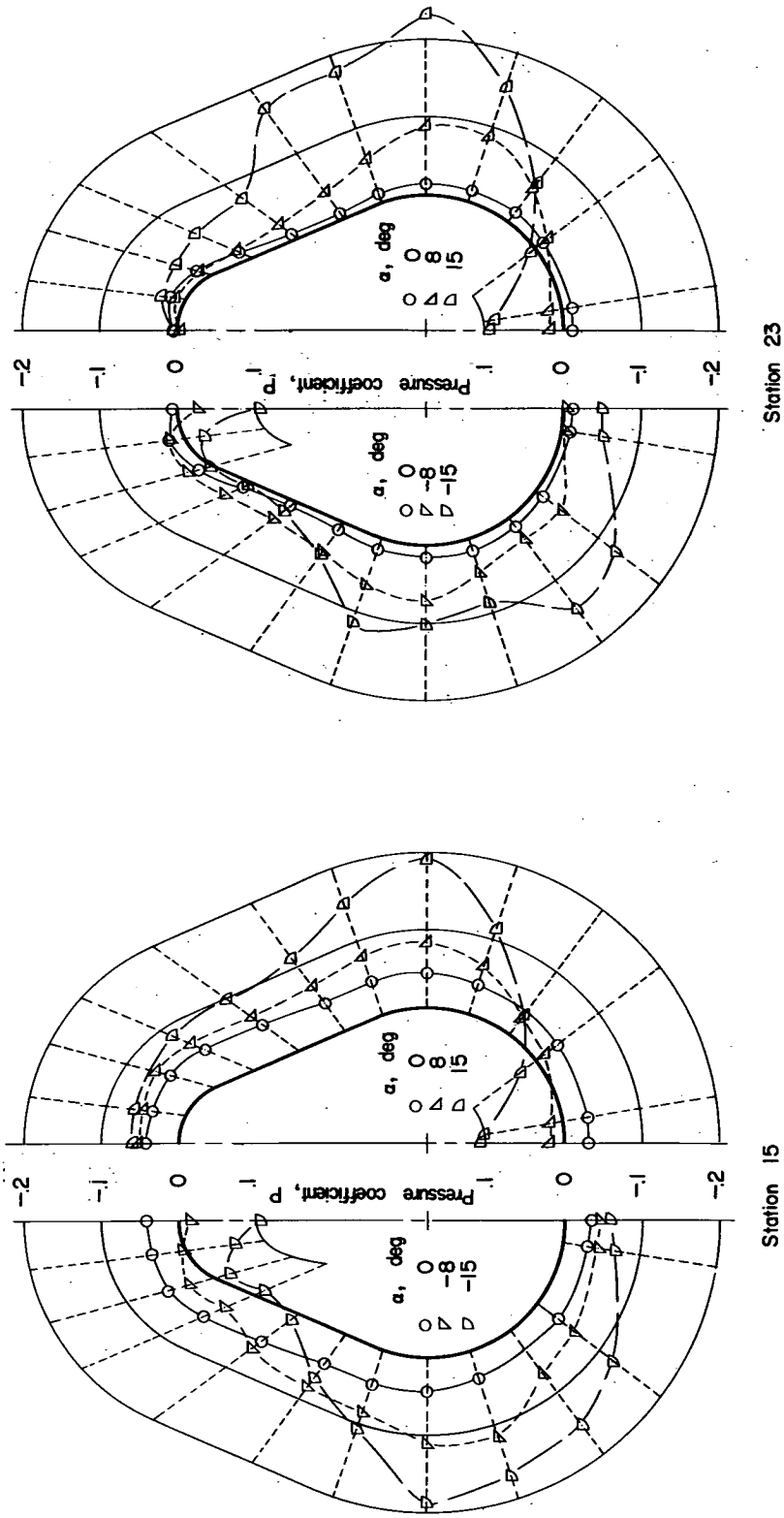
(d) Tent cross section.

Figure 4.- Continued.



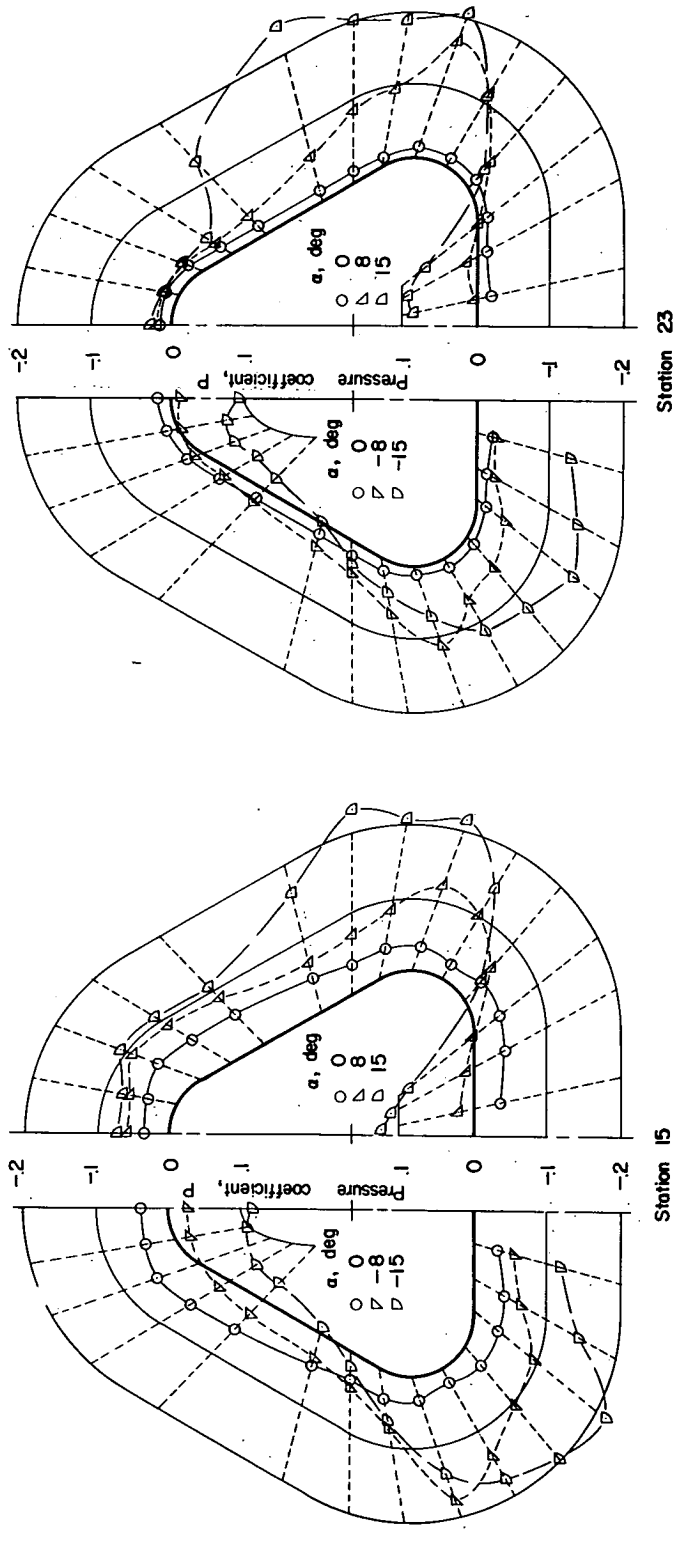
(e) 90° teardrop cross section.

Figure 4.- Continued.



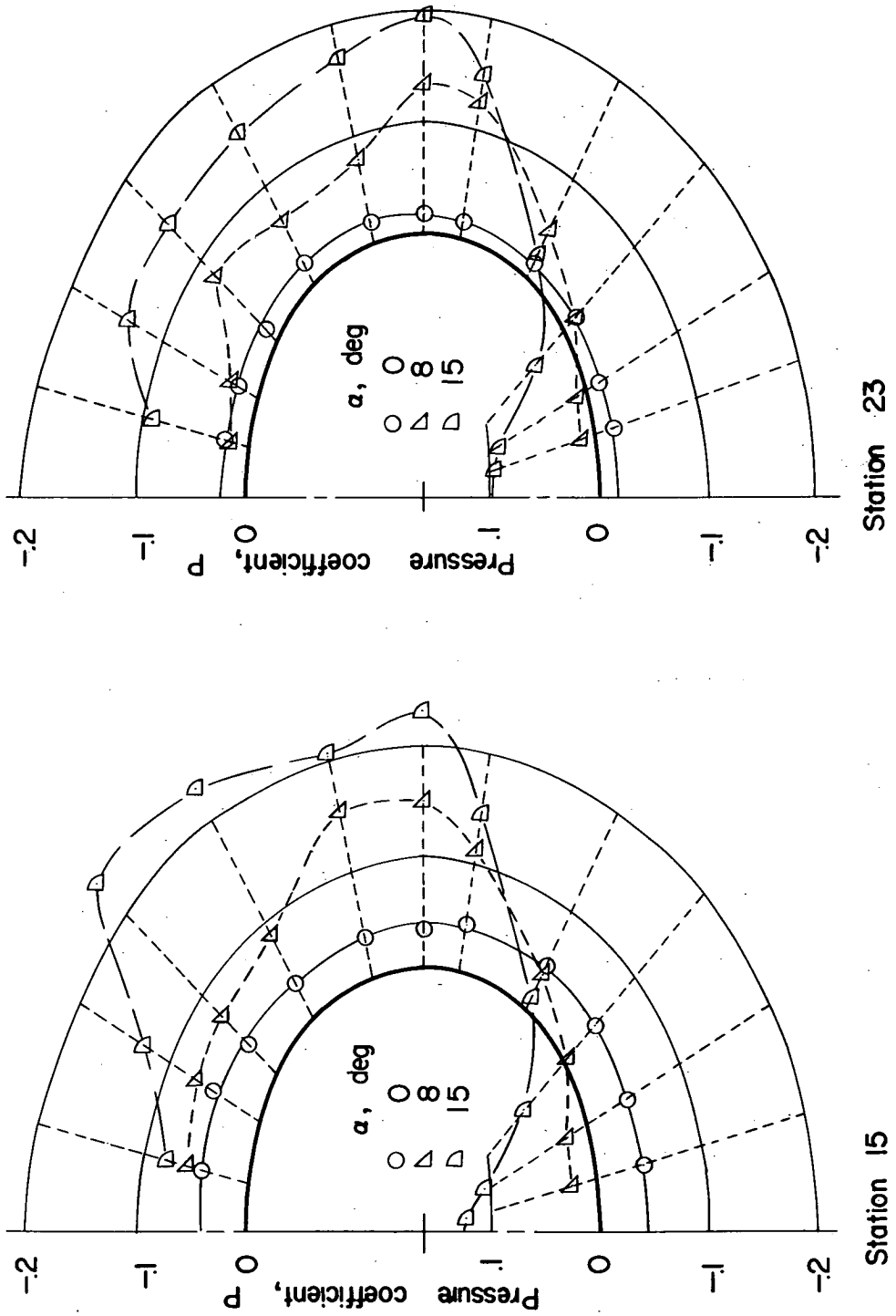
(f) 45° teardrop cross section.

Figure 4.- Continued.



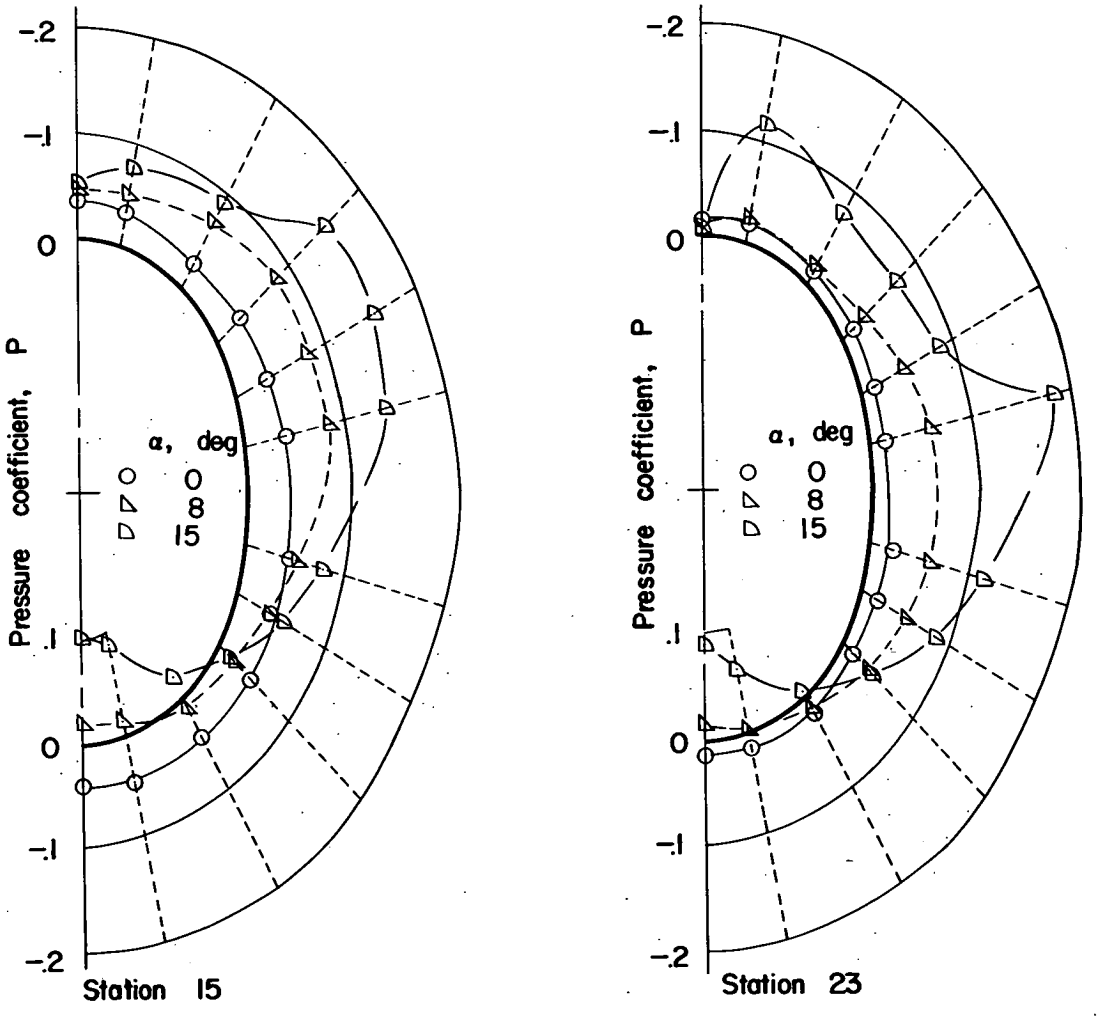
(g) Triangular cross section.

Figure 4.- Continued.



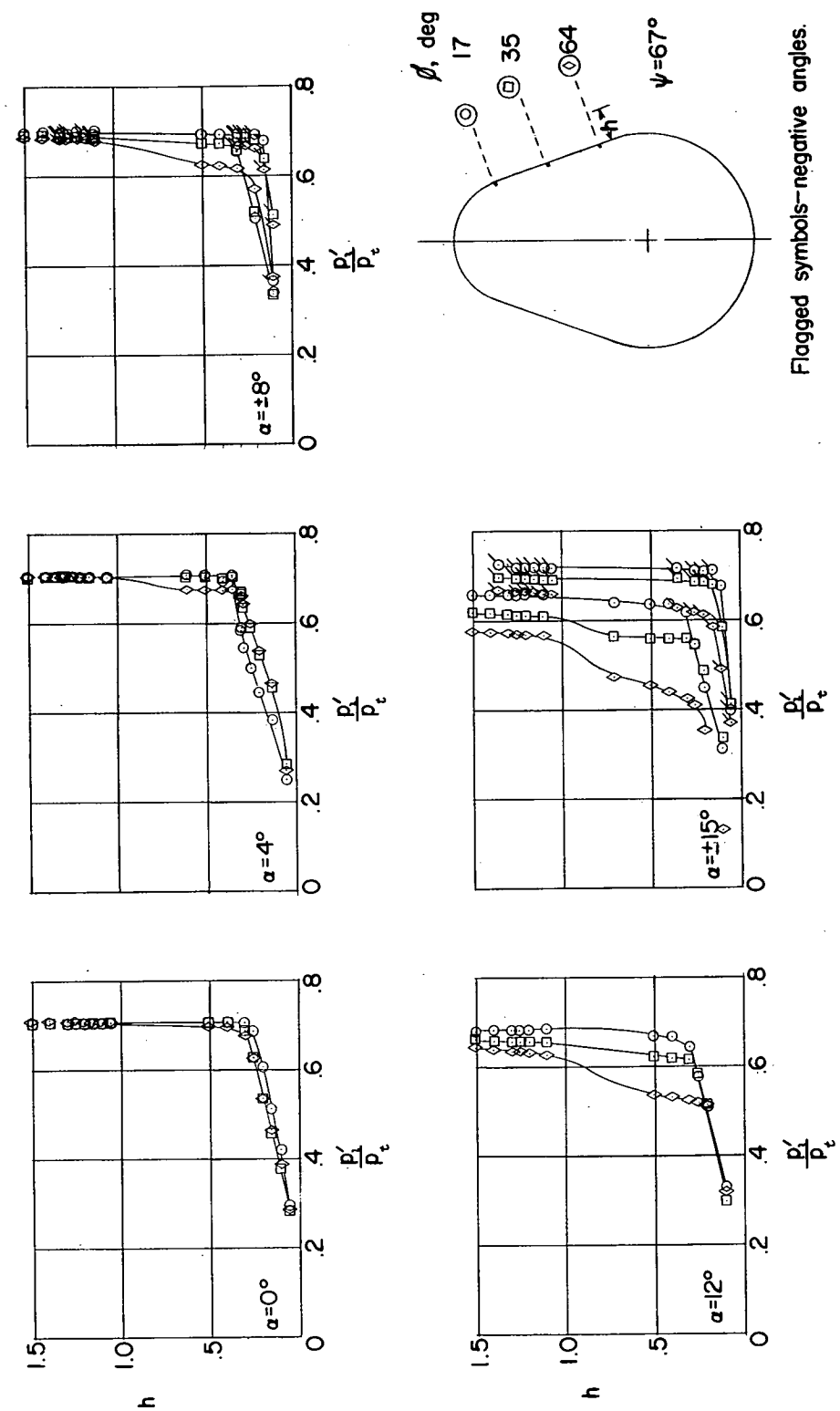
(h) Horizontal-ellipse cross section.

Figure 4.- Continued.



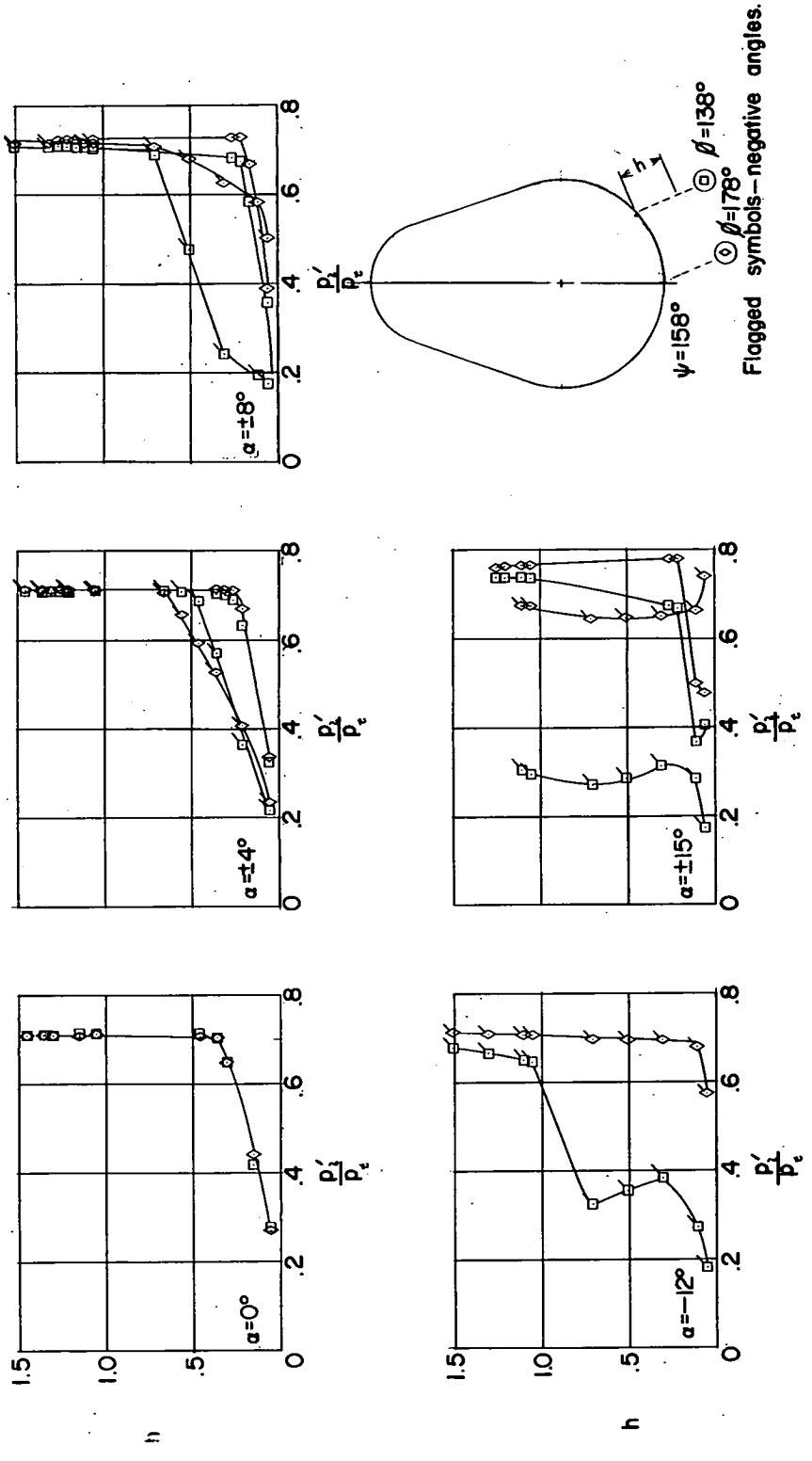
(i) Vertical-ellipse cross section.

Figure 4.- Concluded.



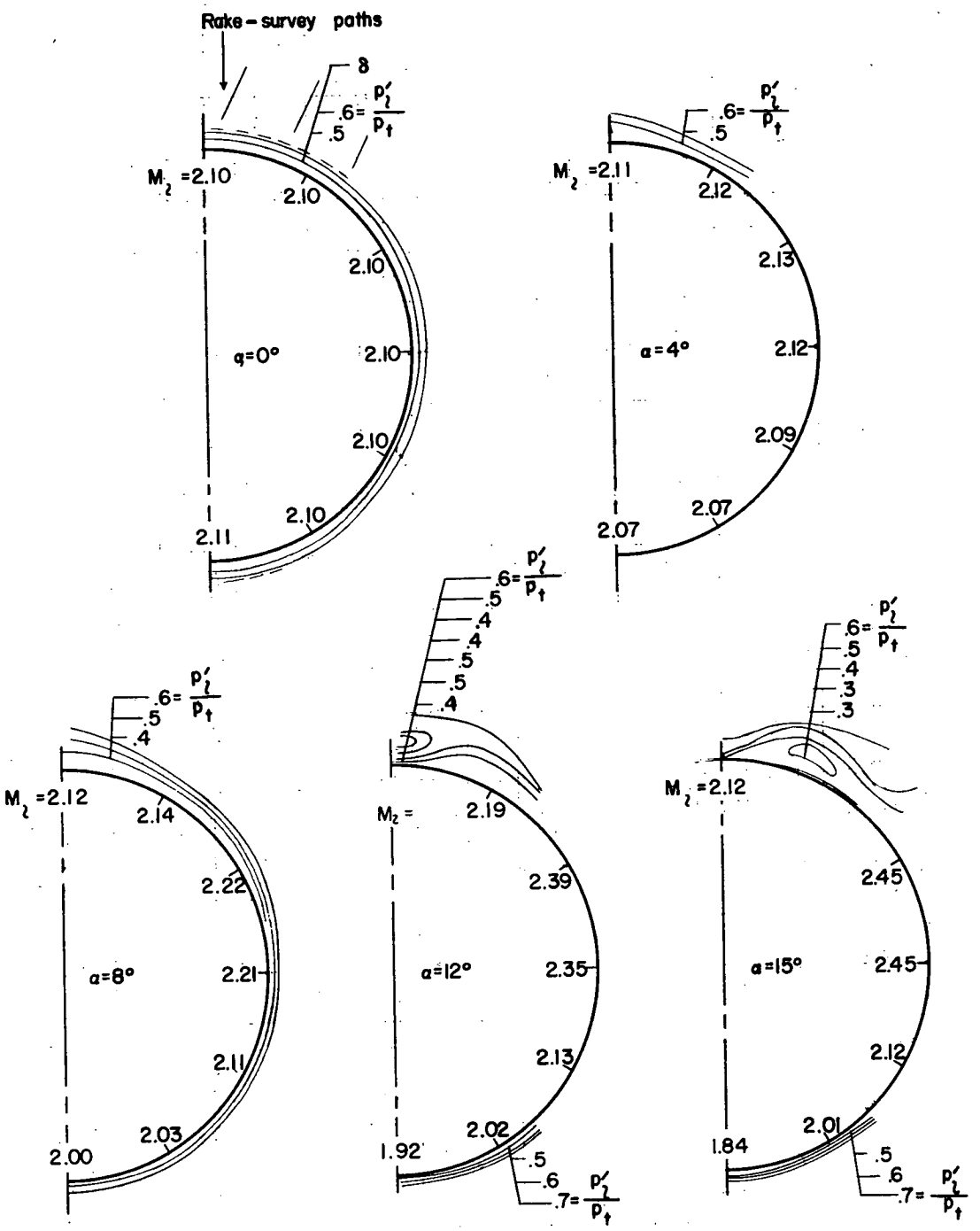
(a) Survey on top side of fuselage.

Figure 5.- Boundary-layer survey data at station 23 on 45° teardrop fuselage.



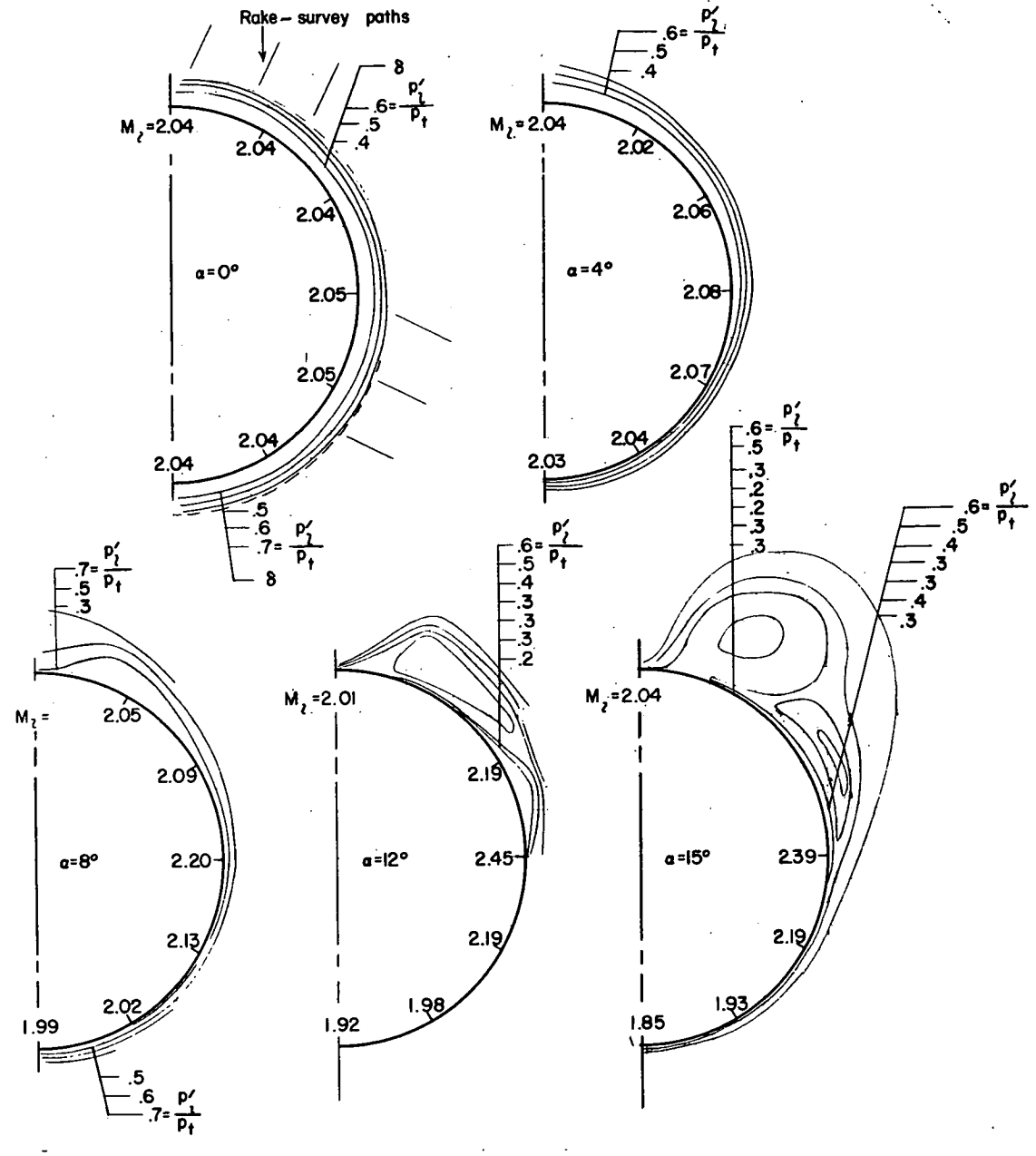
(b) Survey on bottom of fuselage.

Figure 5.- Concluded.



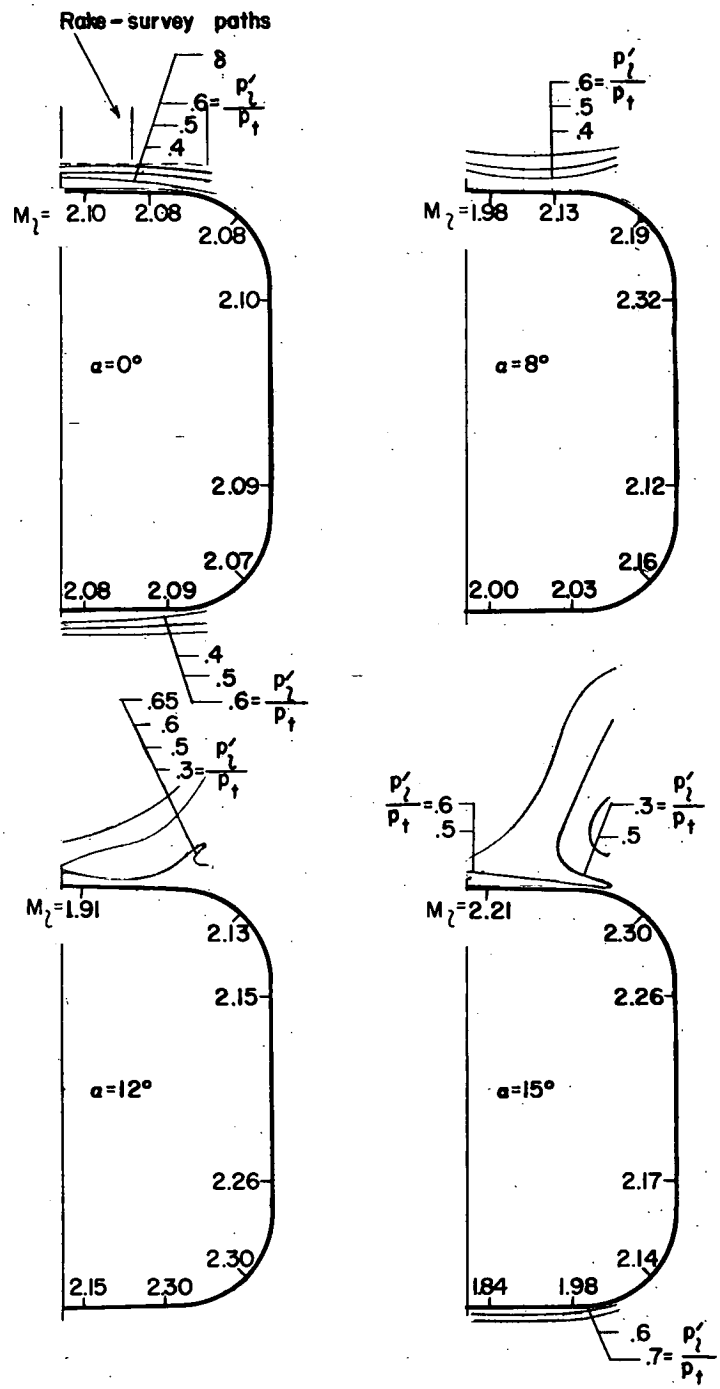
(a) Circular cross section; station 15.

Figure 6.- Impact-pressure contours of fuselage flow field.



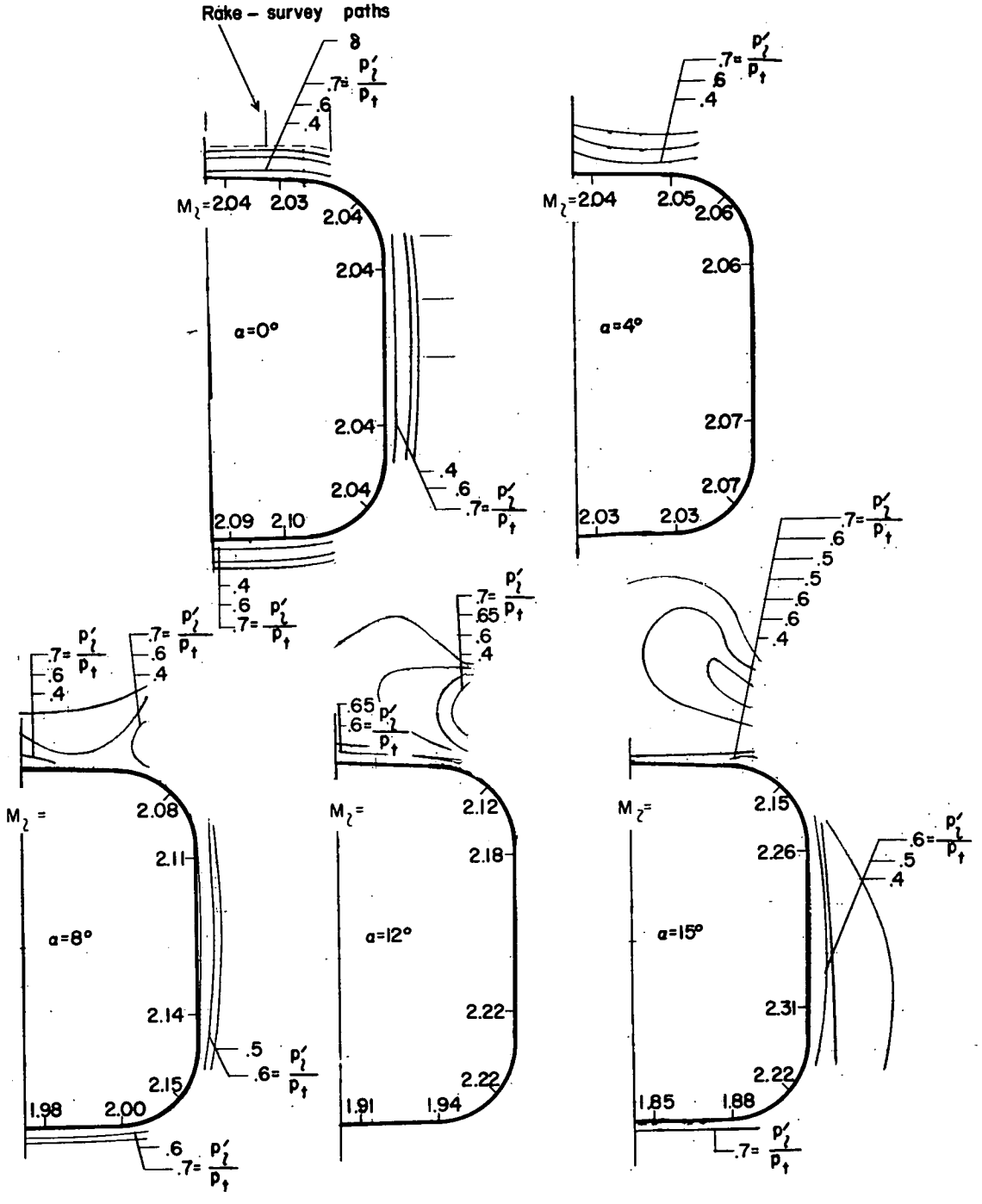
(b) Circular cross section; station 23.

Figure 6.- Continued.



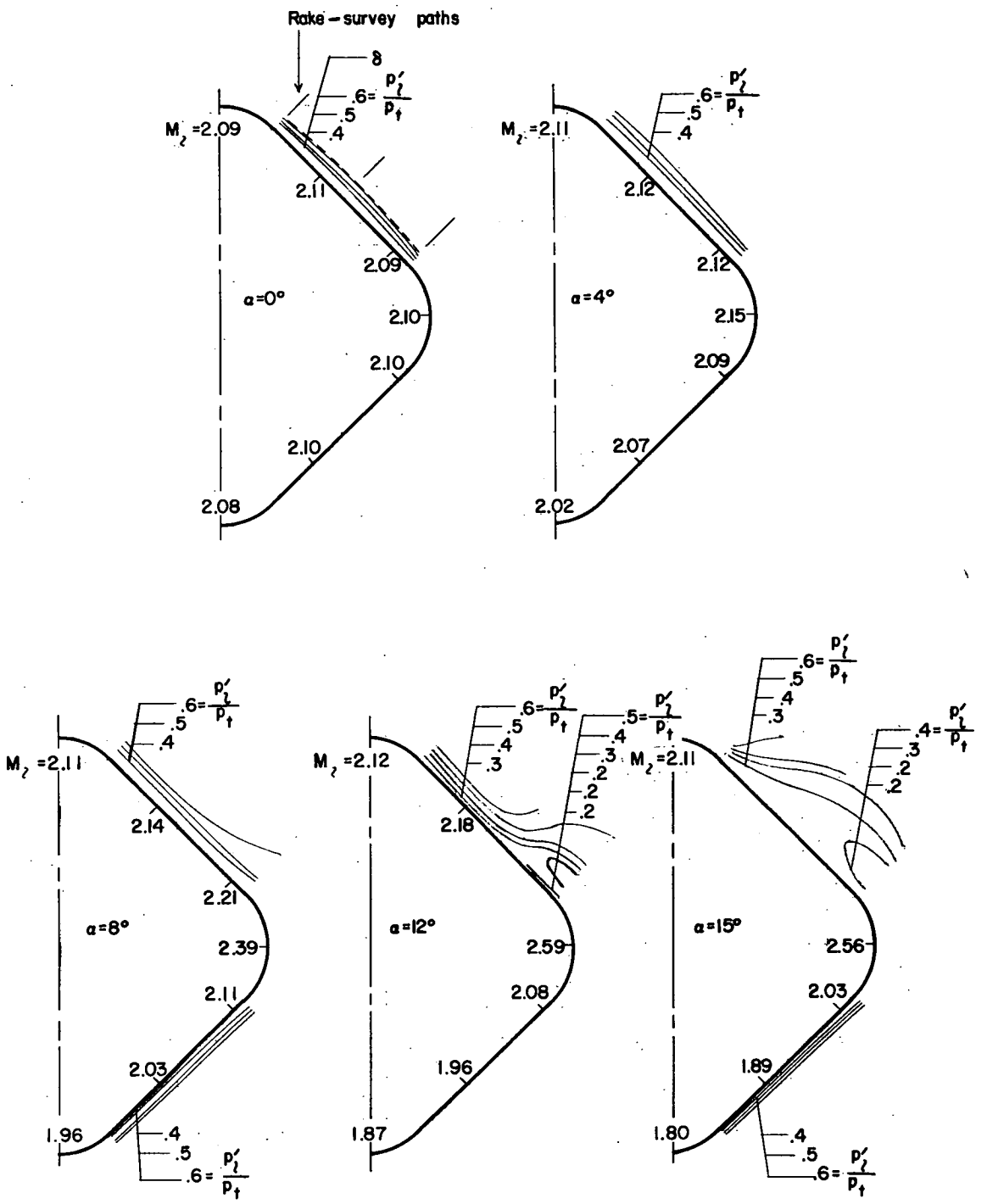
(c) Square cross section; station 15.

Figure 6.- Continued.



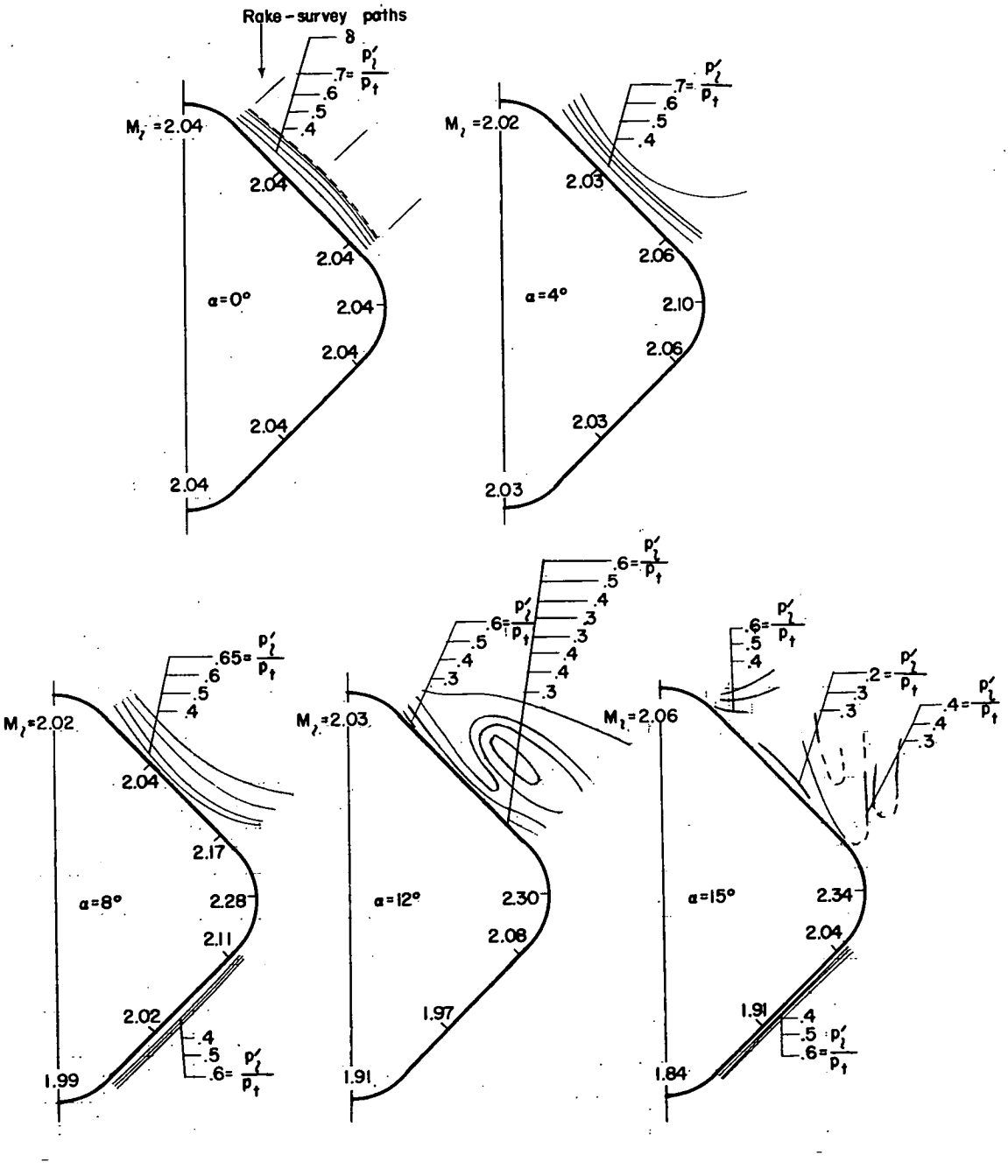
(d) Square cross section; station 23.

Figure 6.- Continued.



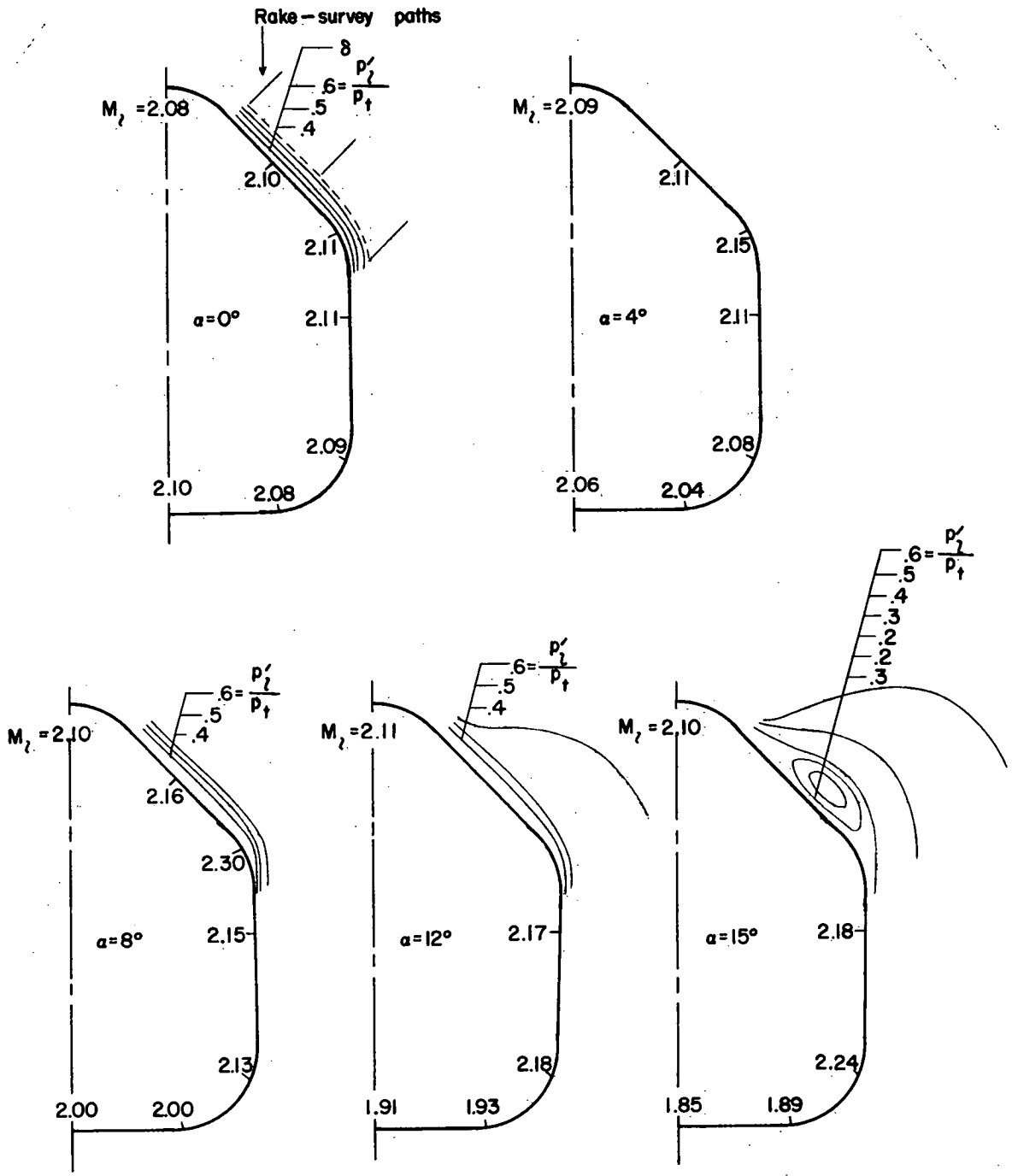
(e) Diamond cross section; station 15.

Figure 6.- Continued.



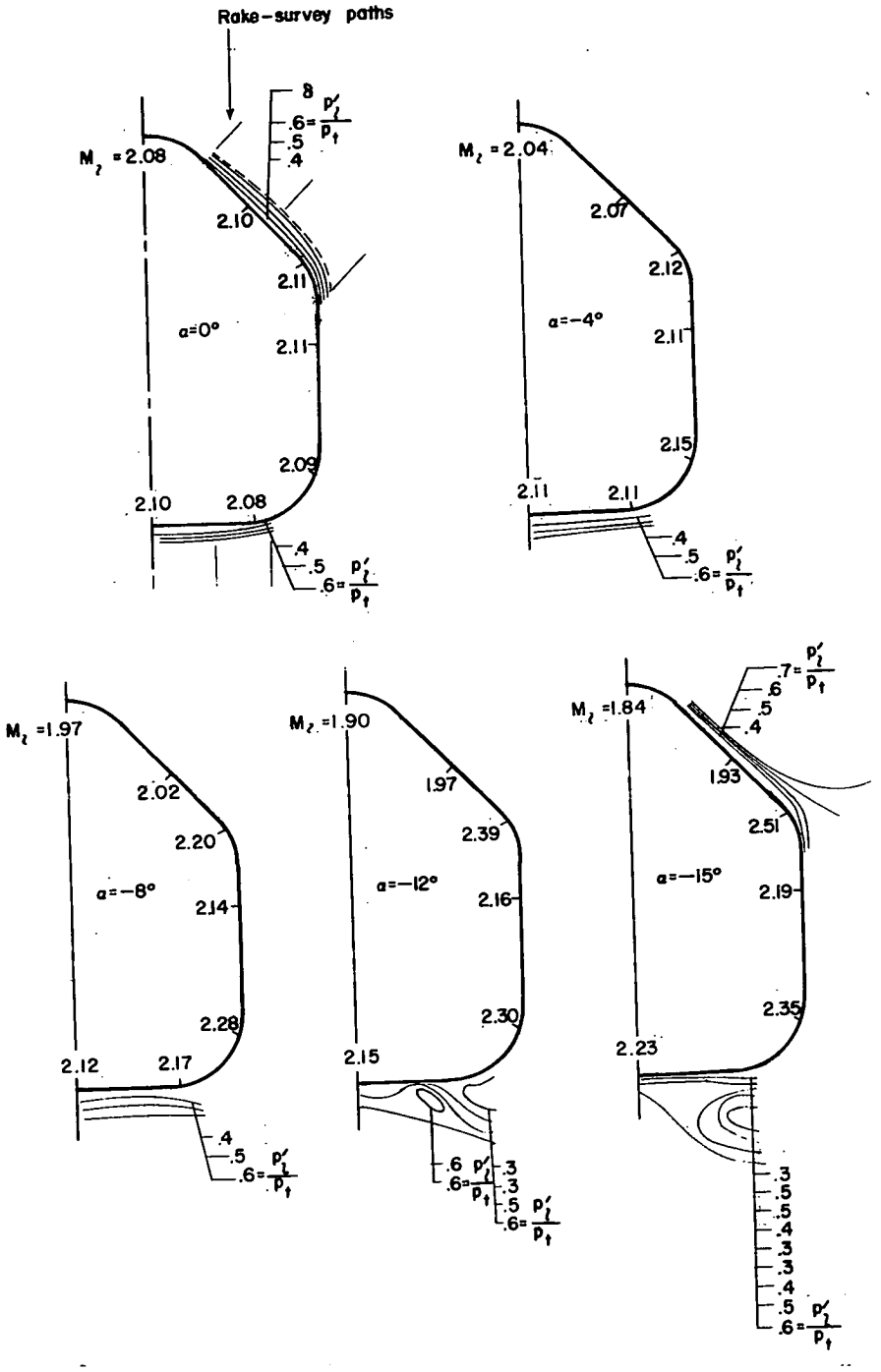
(f) Diamond cross section; station 23.

Figure 6.- Continued.



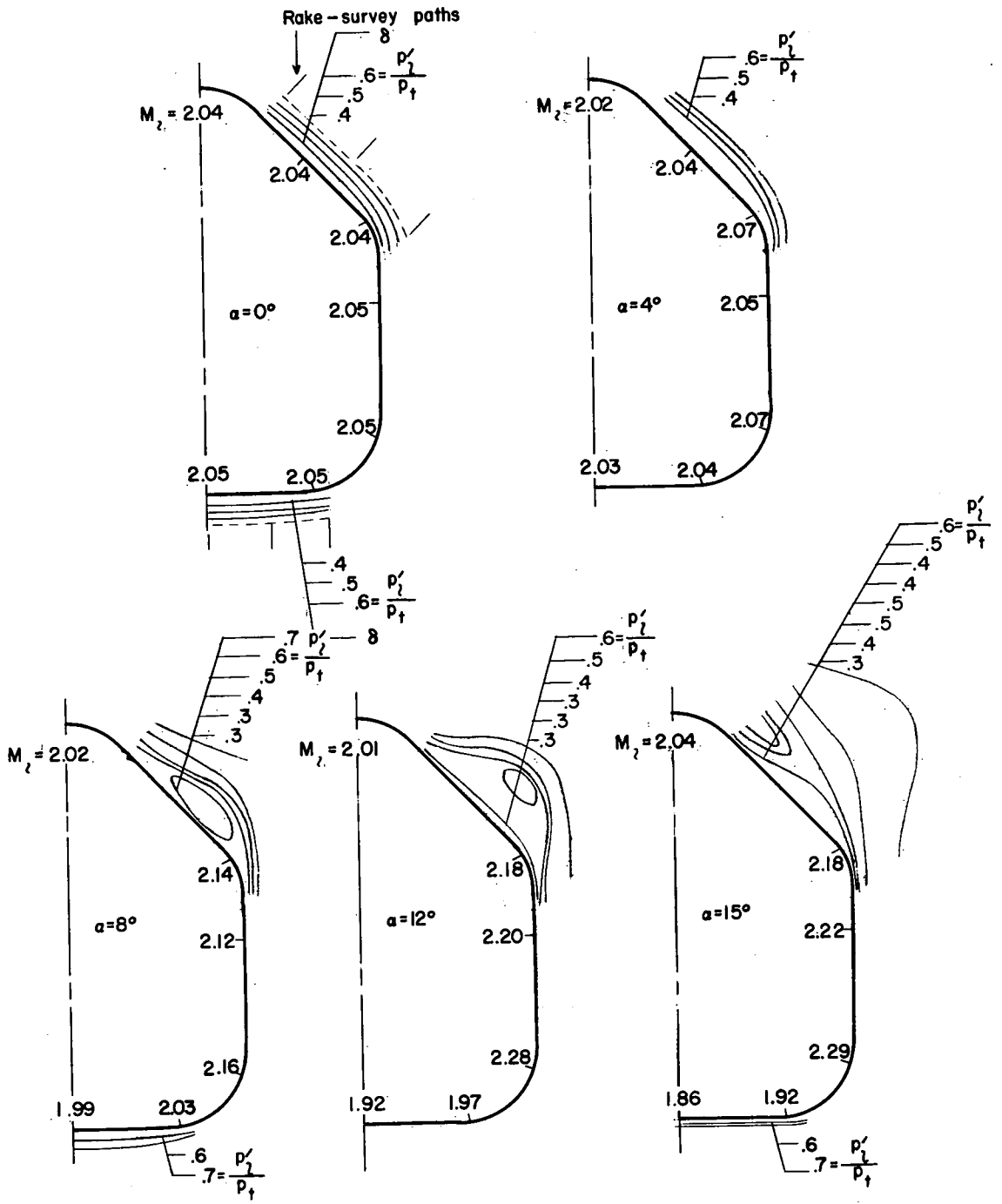
(g) Tent cross section; station 15.

Figure 6.- Continued.



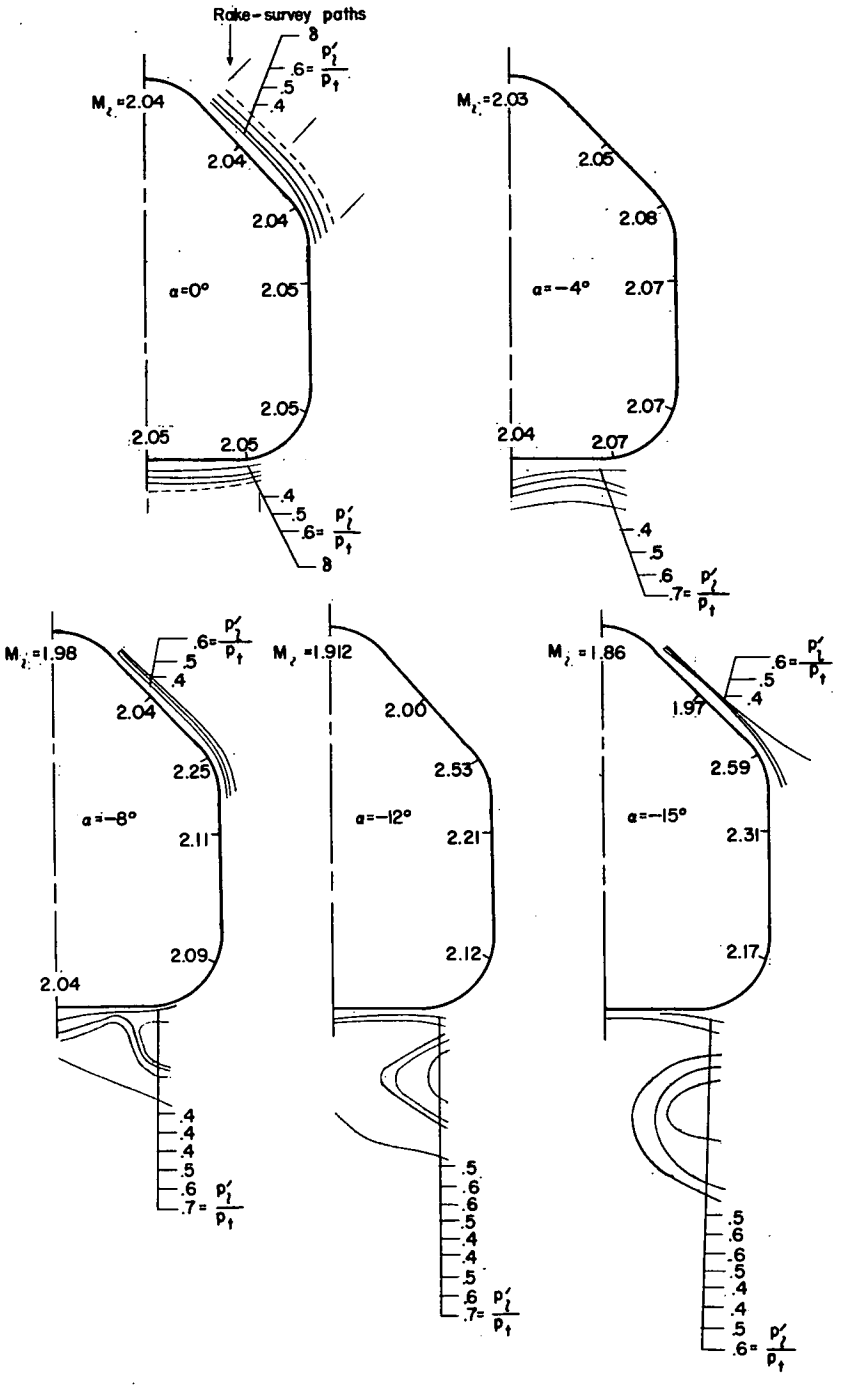
(h) Tent cross section; station 15.

Figure 6.- Continued.



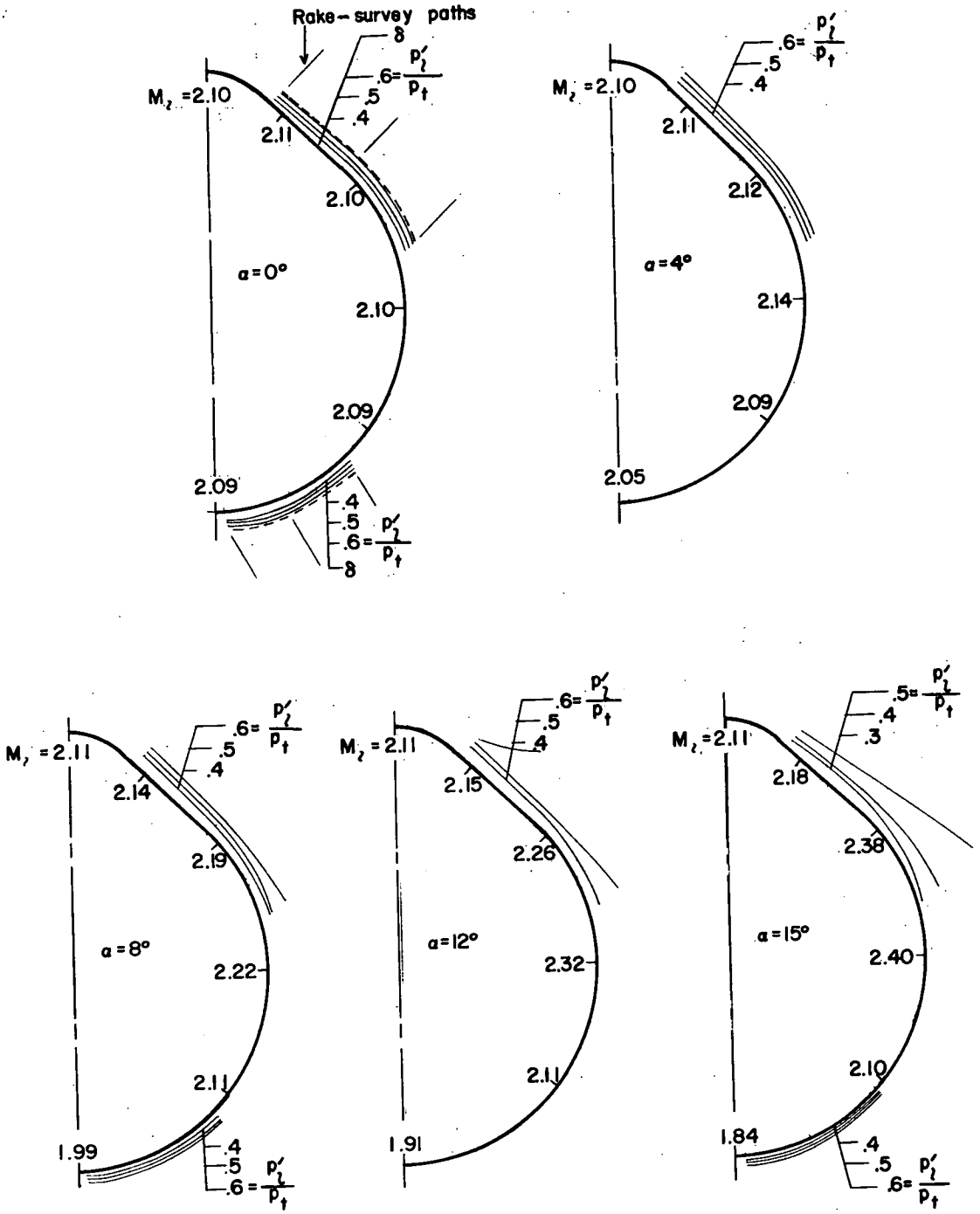
(i) Tent cross section; station 23.

Figure 6.- Continued.



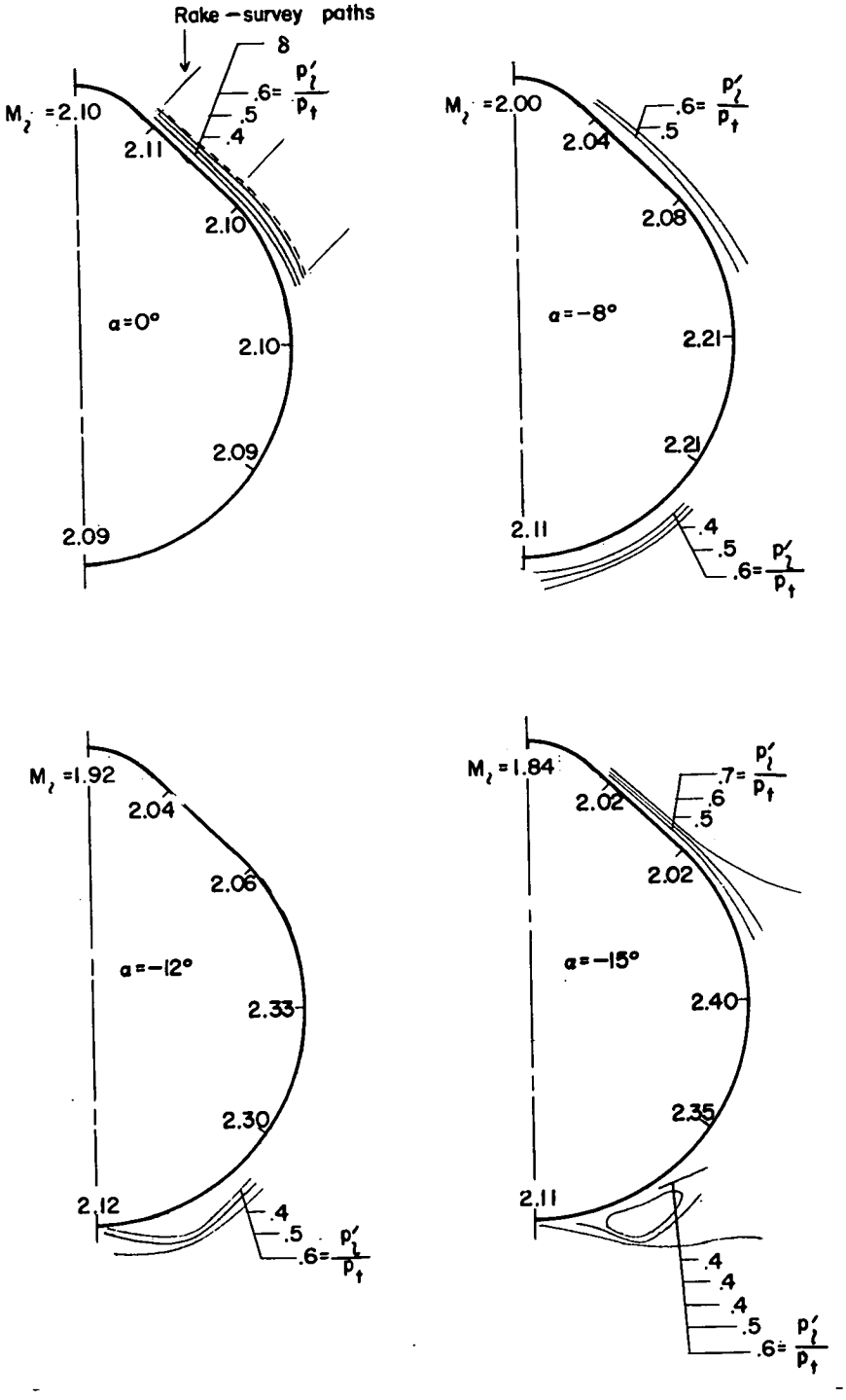
(j) Tent cross section; station 23.

Figure 6.- Continued.



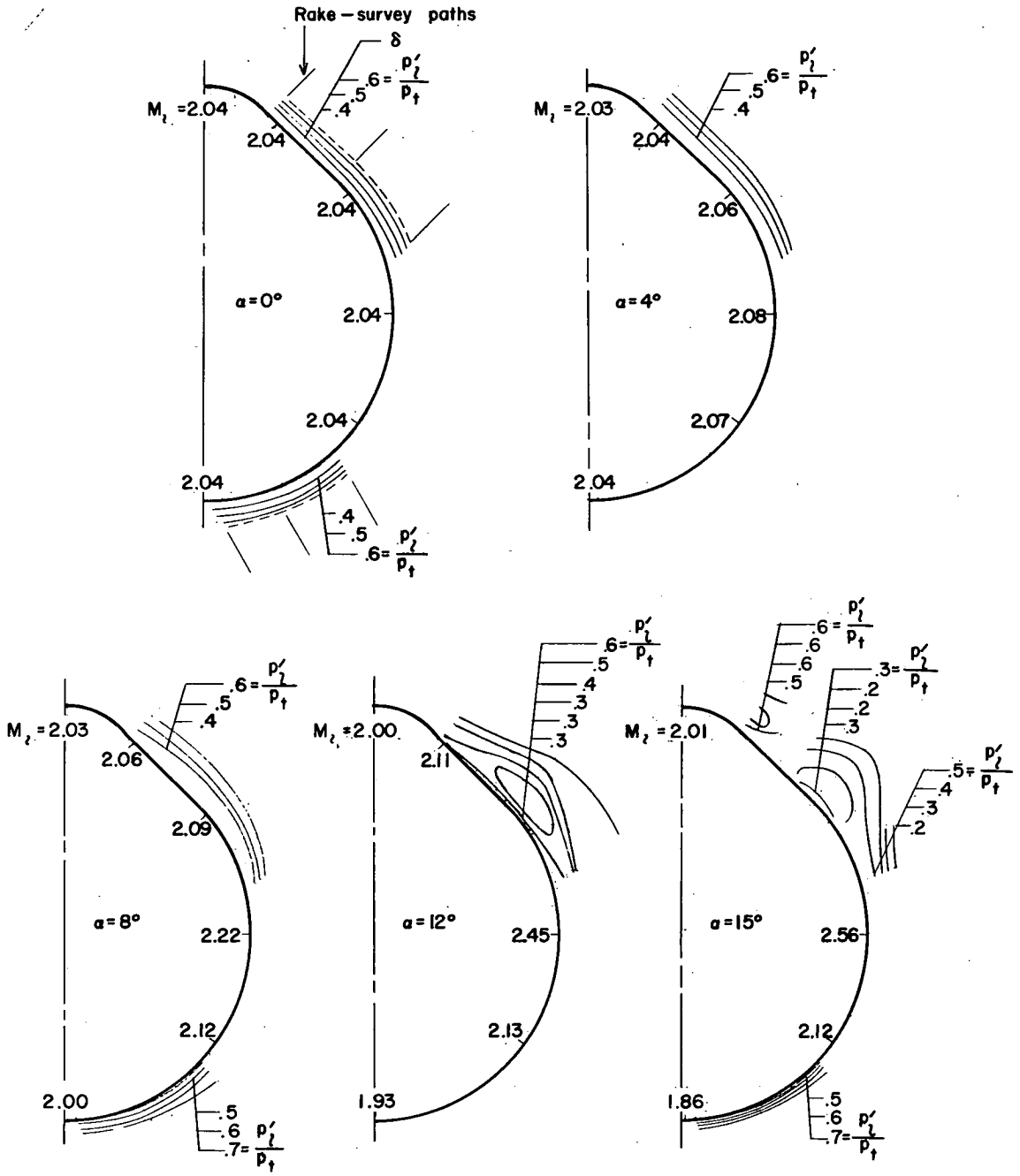
(k) 90° teardrop cross section; station 15.

Figure 6.- Continued.



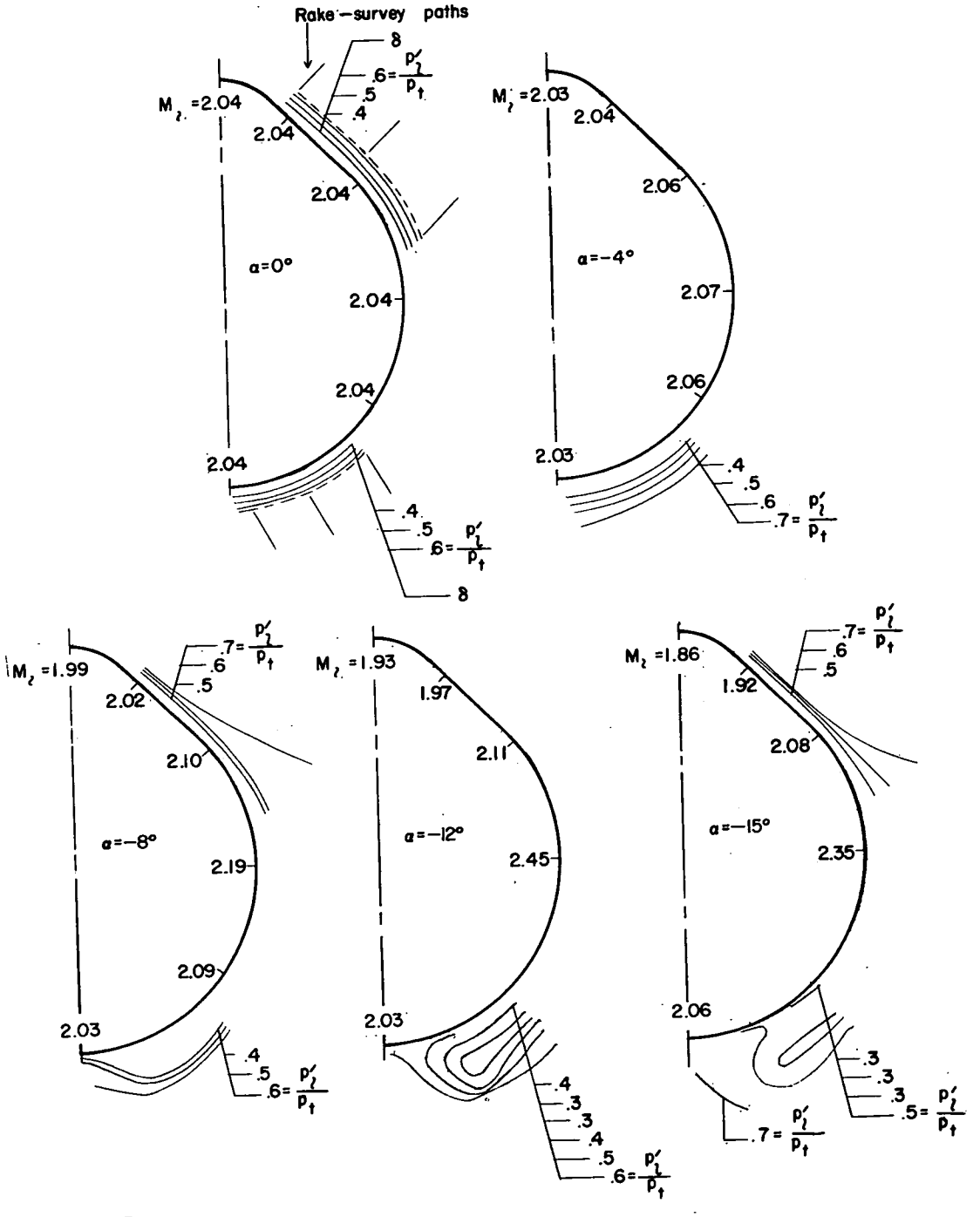
(*l*) 90° teardrop cross section; station 15.

Figure 6.- Continued.



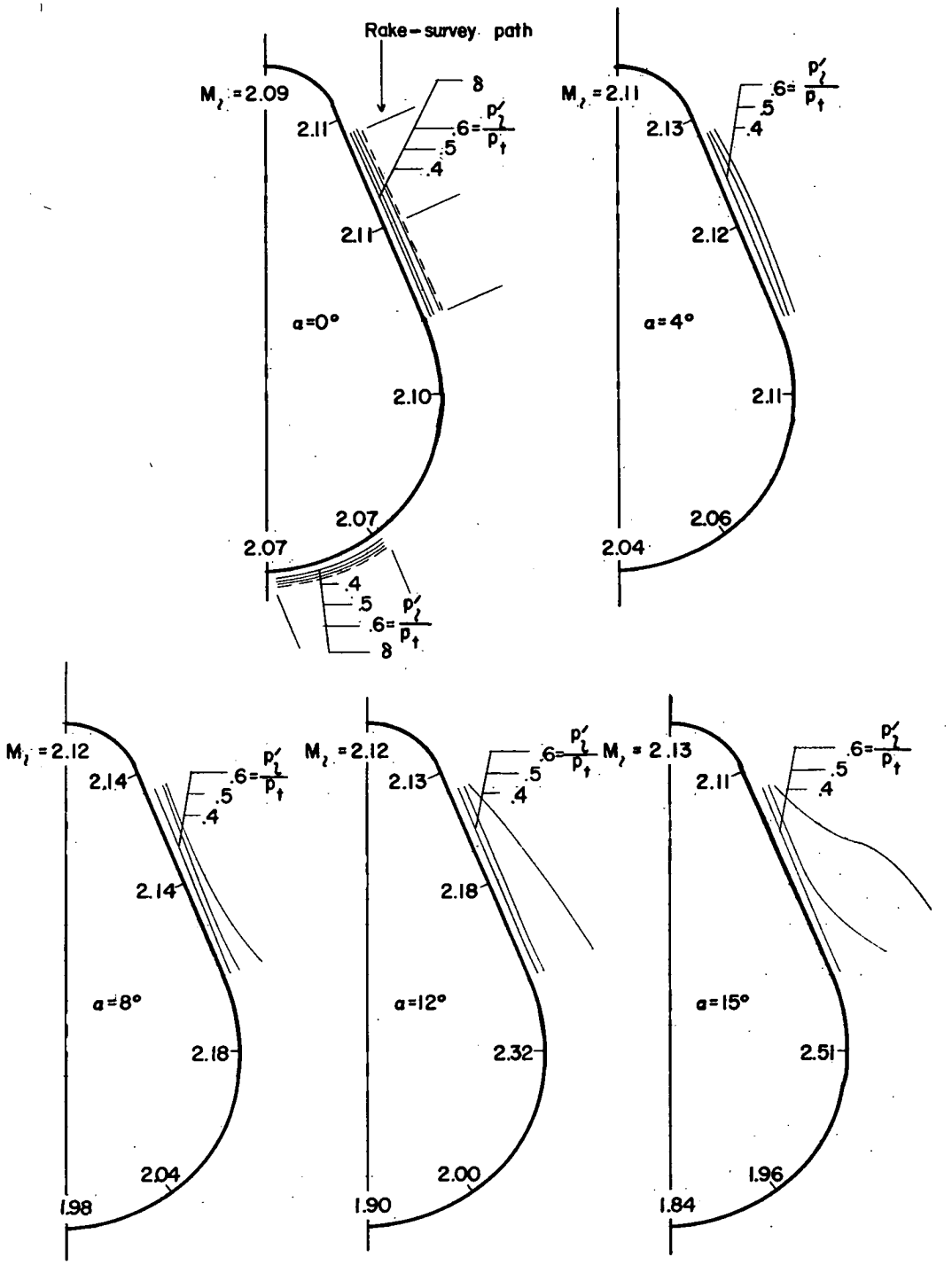
(m) 90° teardrop cross section; station 23.

Figure 6.- Continued.



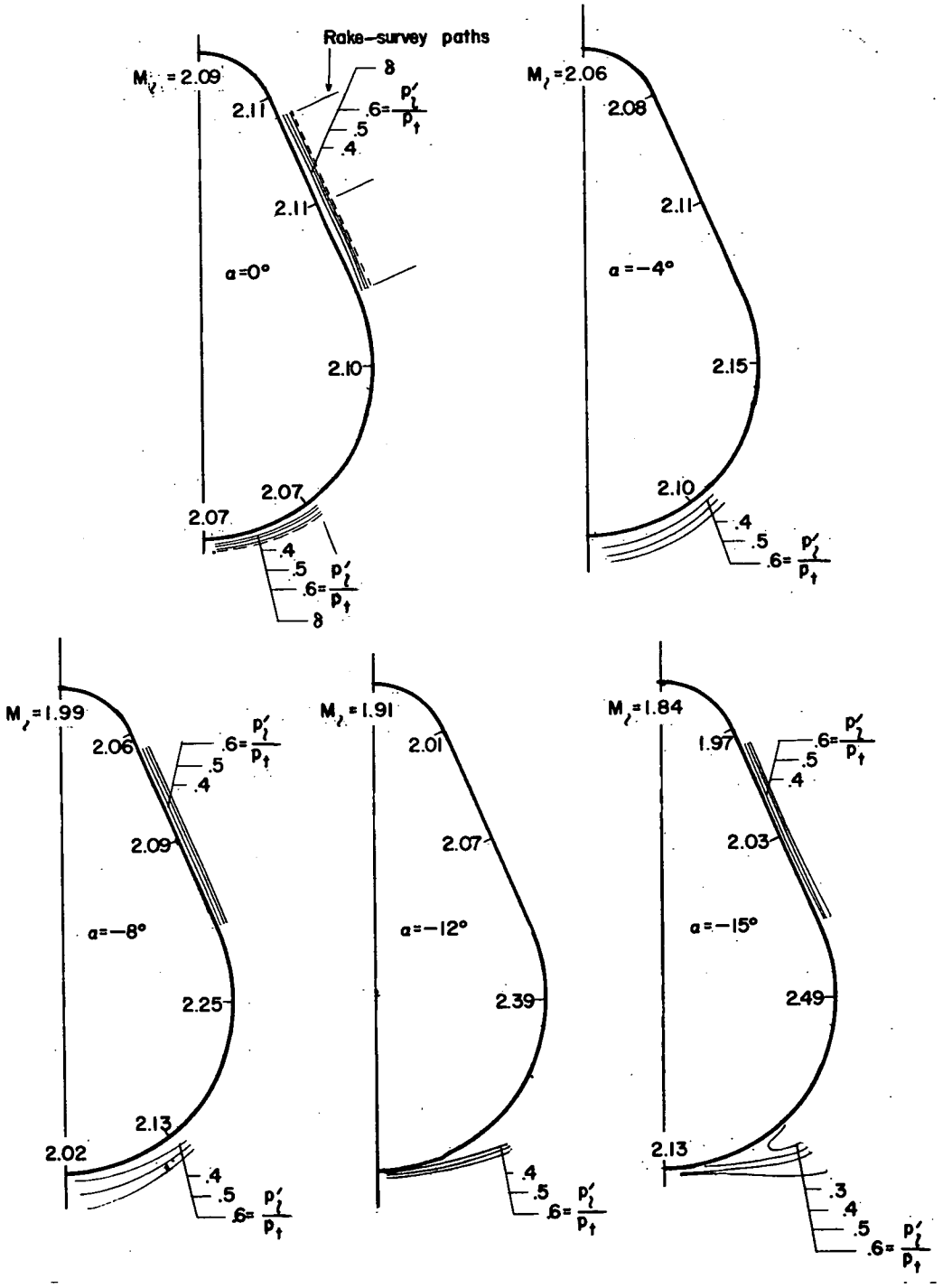
(n) 90° teardrop cross section; station 23.

Figure 6.- Continued.



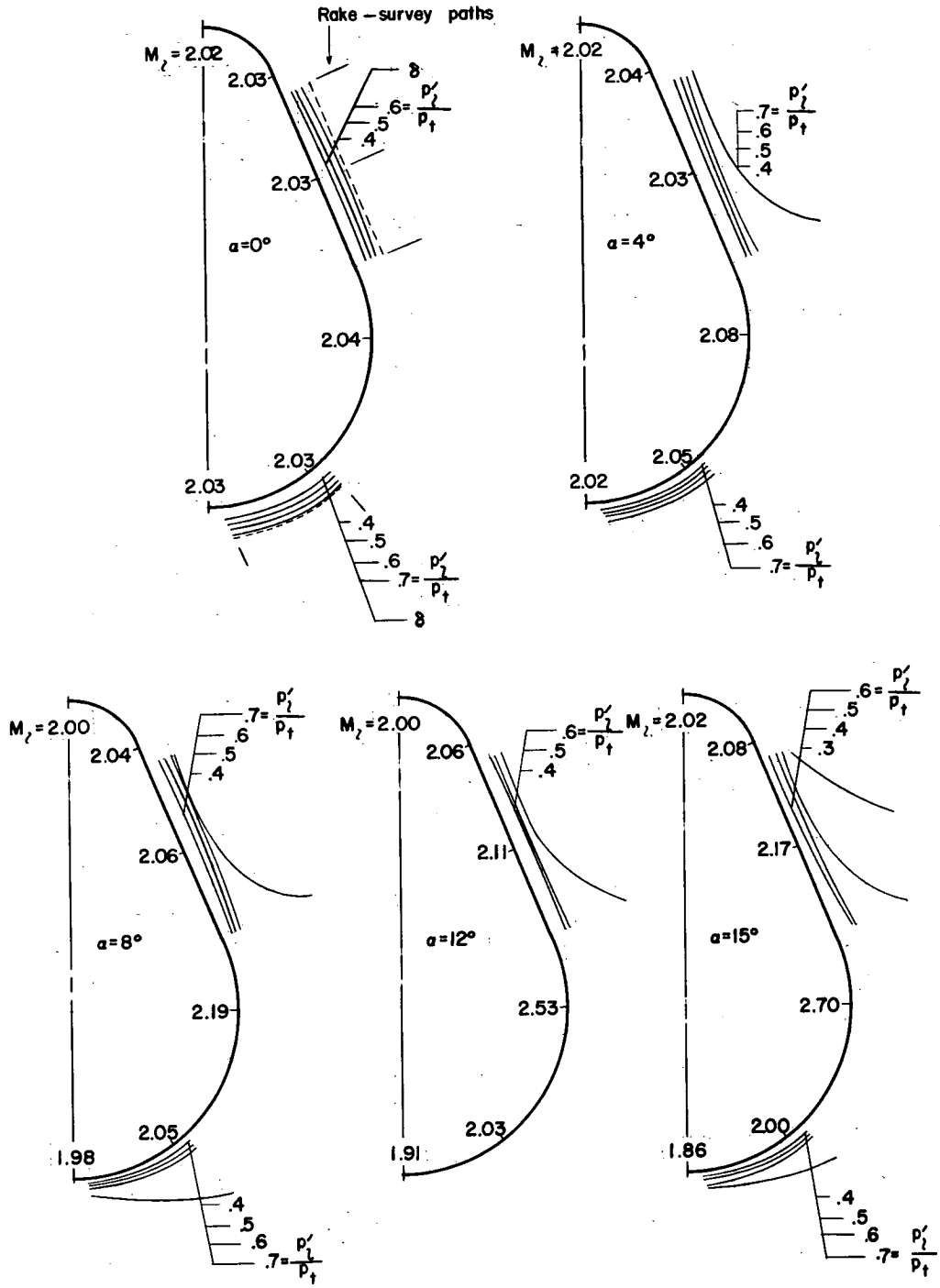
(o) 45° teardrop cross section, station 15.

Figure 6.- Continued.



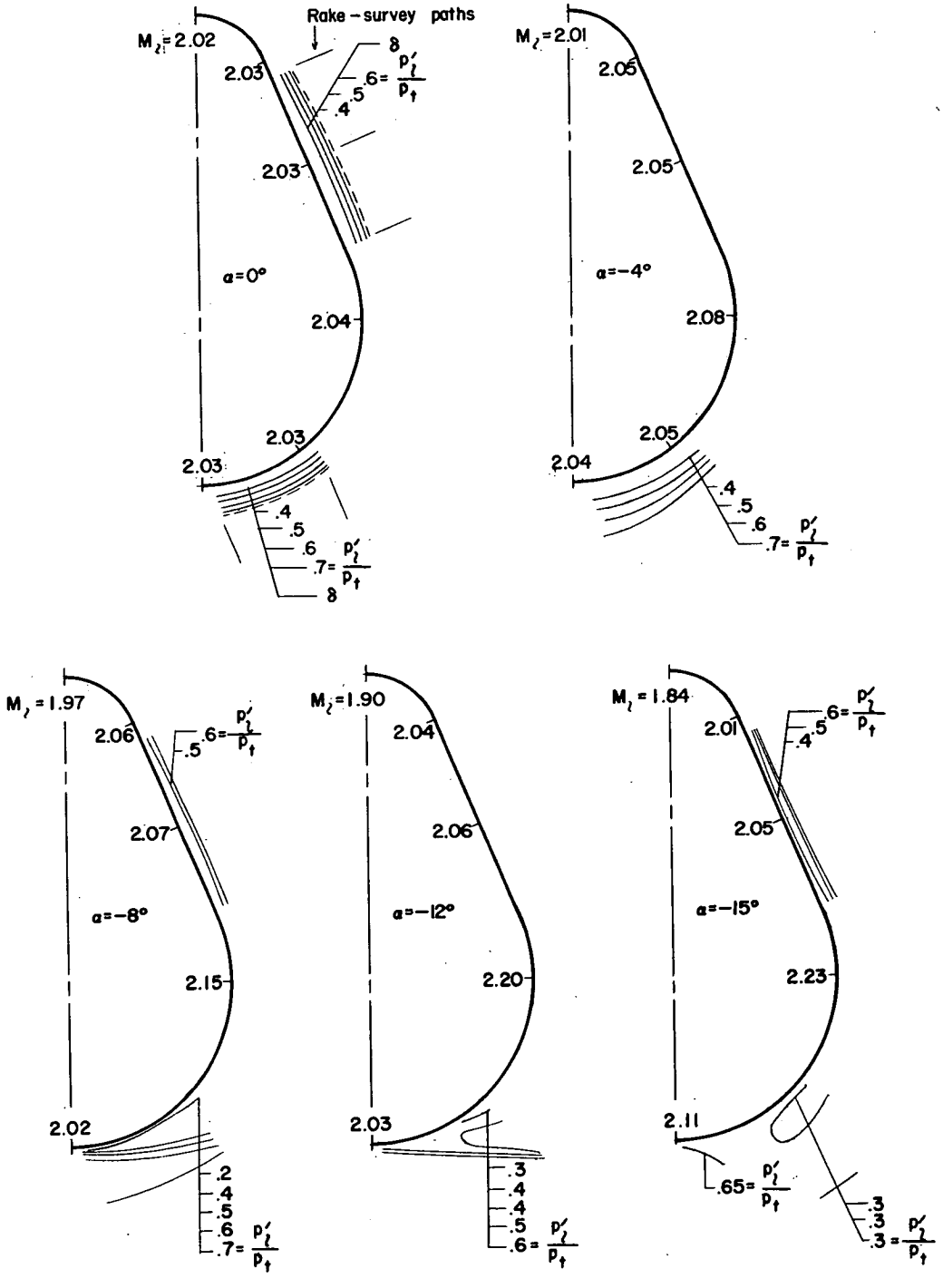
(p) 45° teardrop cross section; station 15.

Figure 6.- Continued.



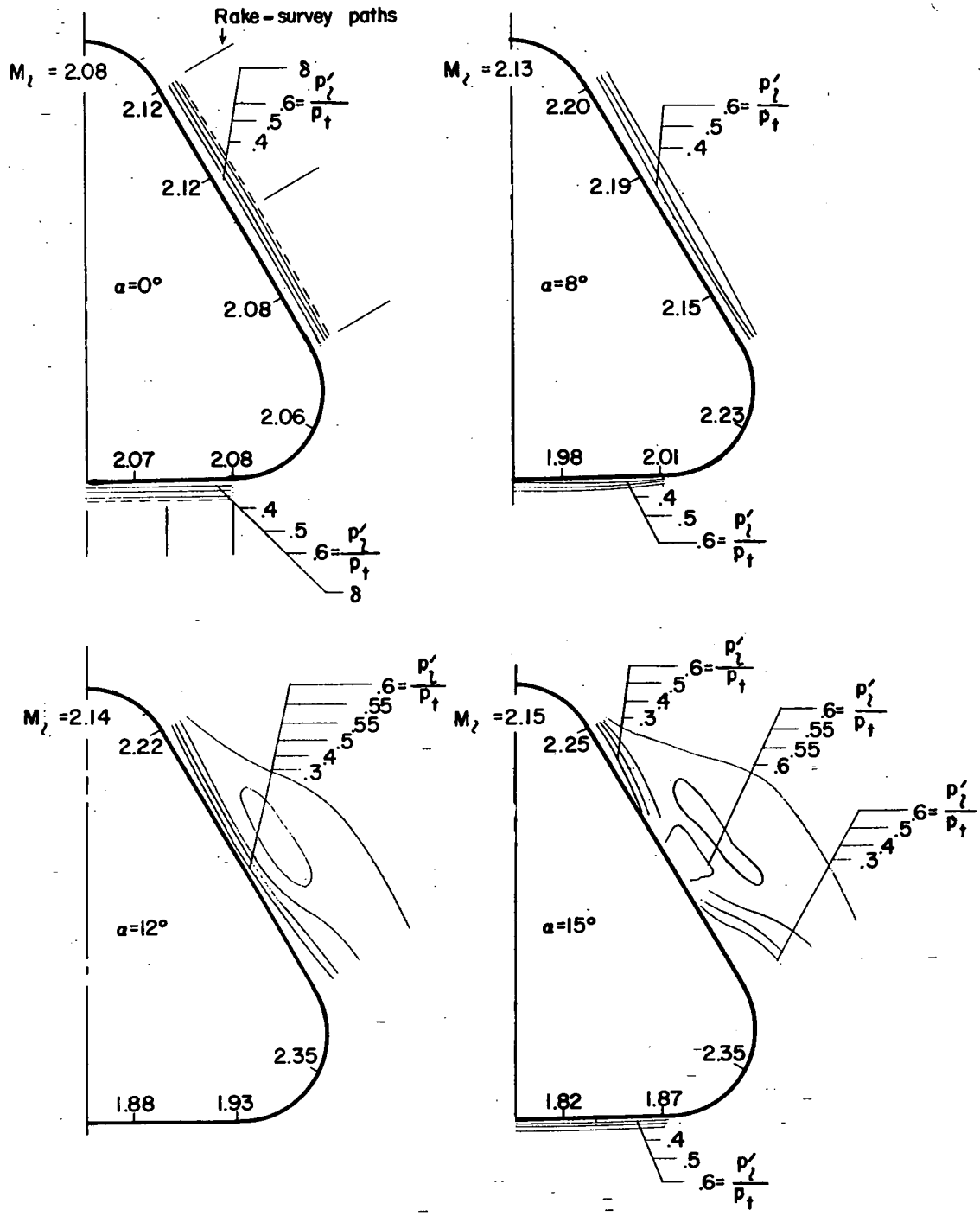
(q) 45° teardrop cross section; station 23.

Figure 6.- Continued.



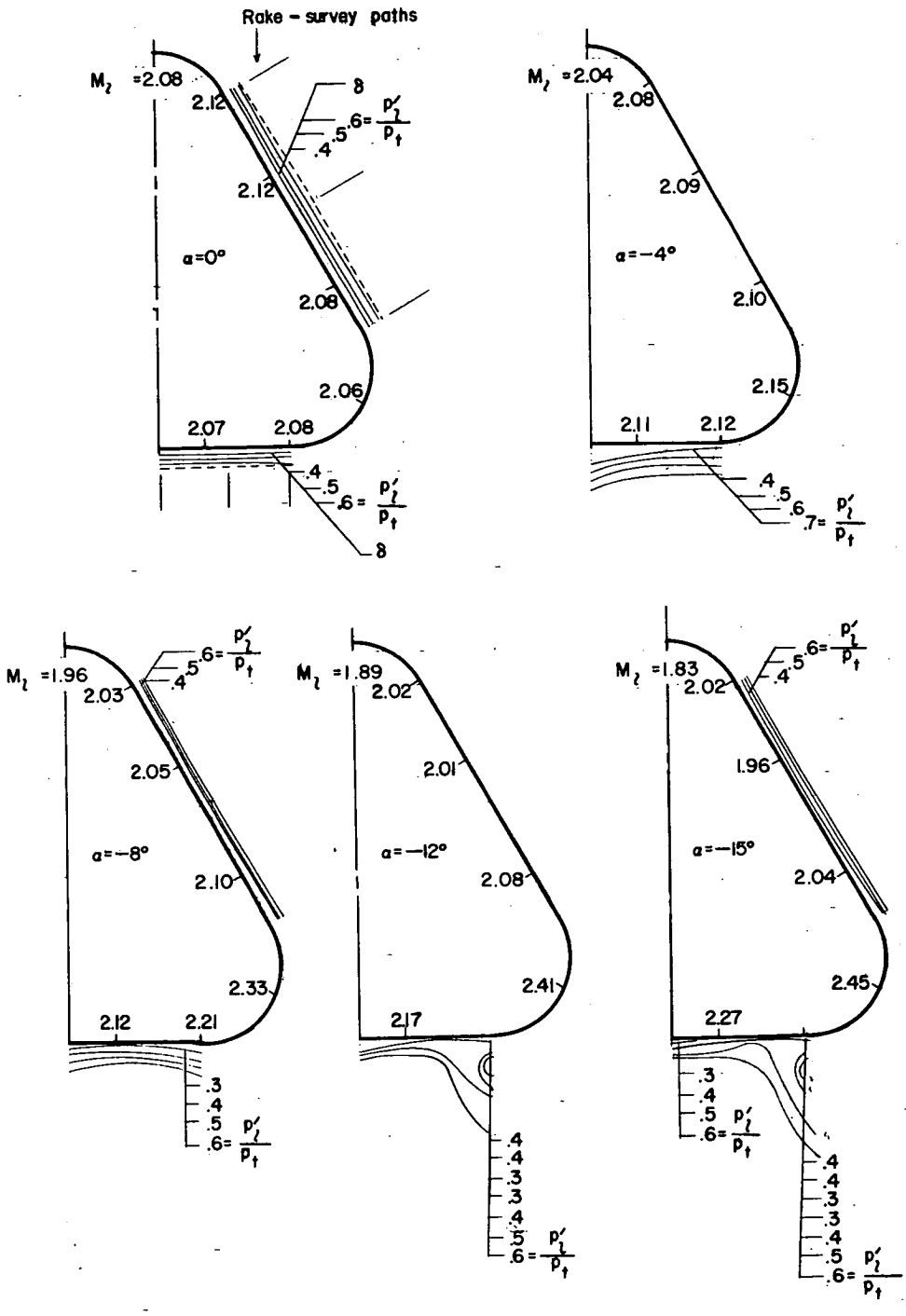
(r) 45° teardrop cross section; station 23.

Figure 6.- Continued.



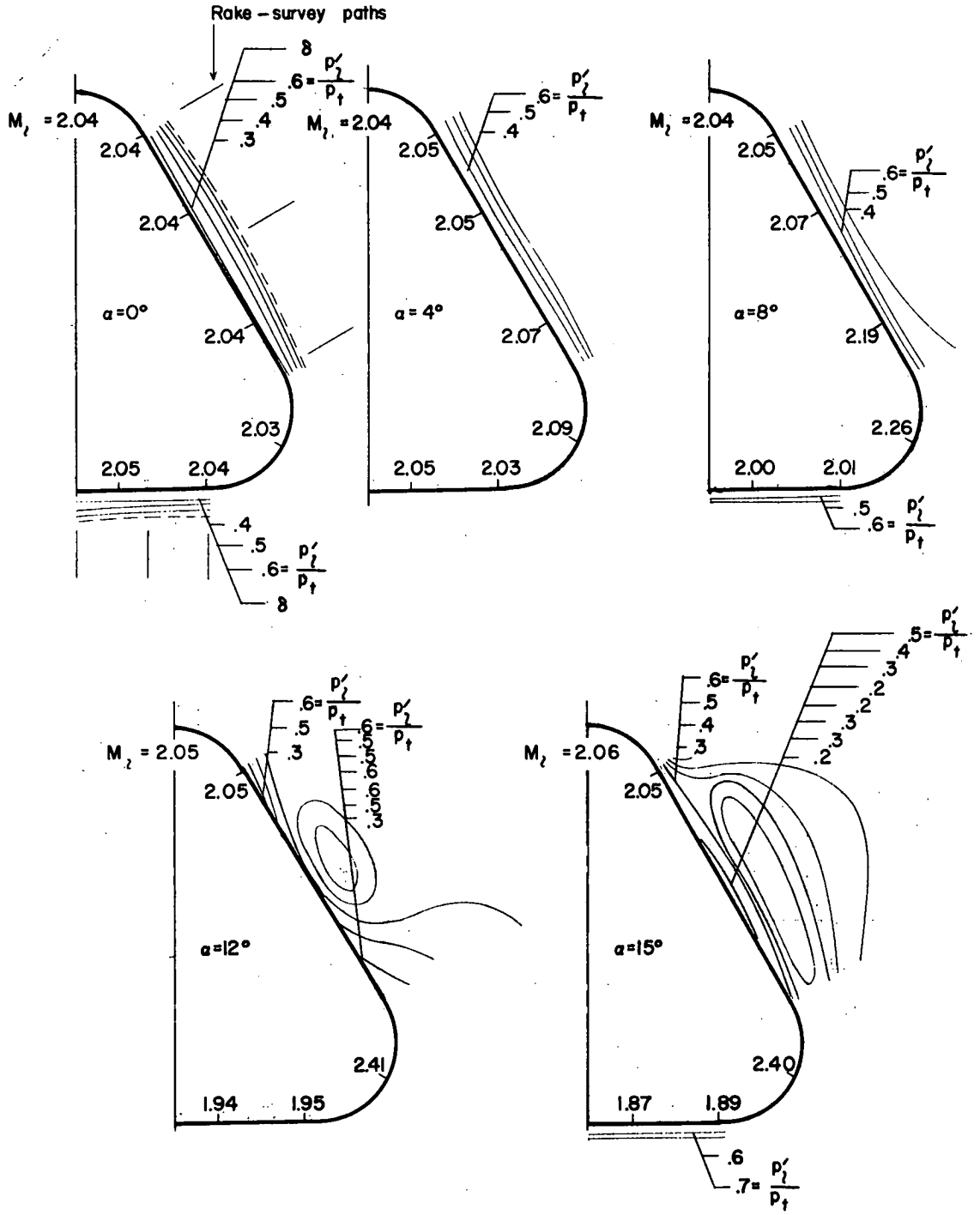
(s) Triangle cross section; station 15.

Figure 6.- Continued.



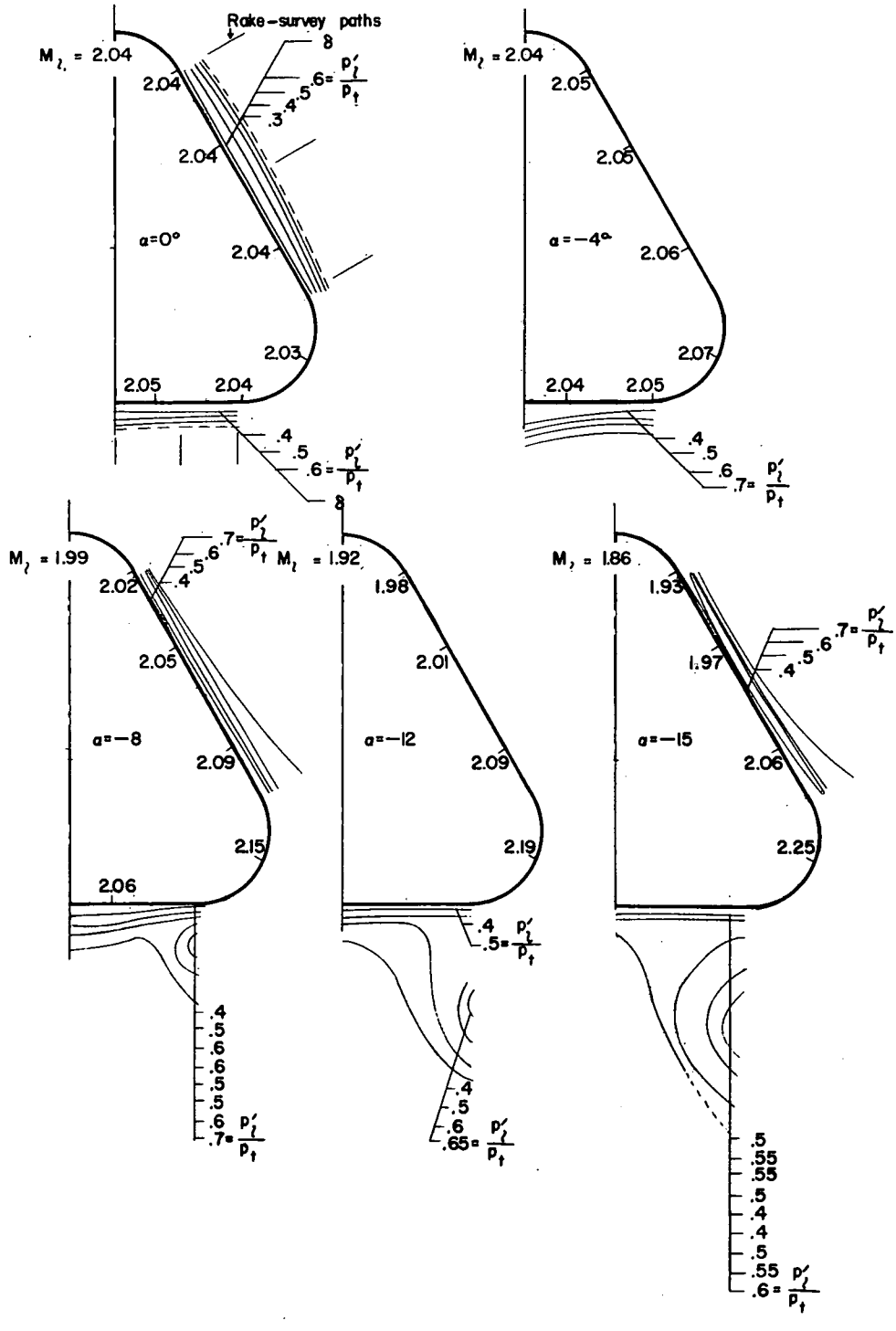
(t) Triangle cross section; station 15.

Figure 6.- Continued.



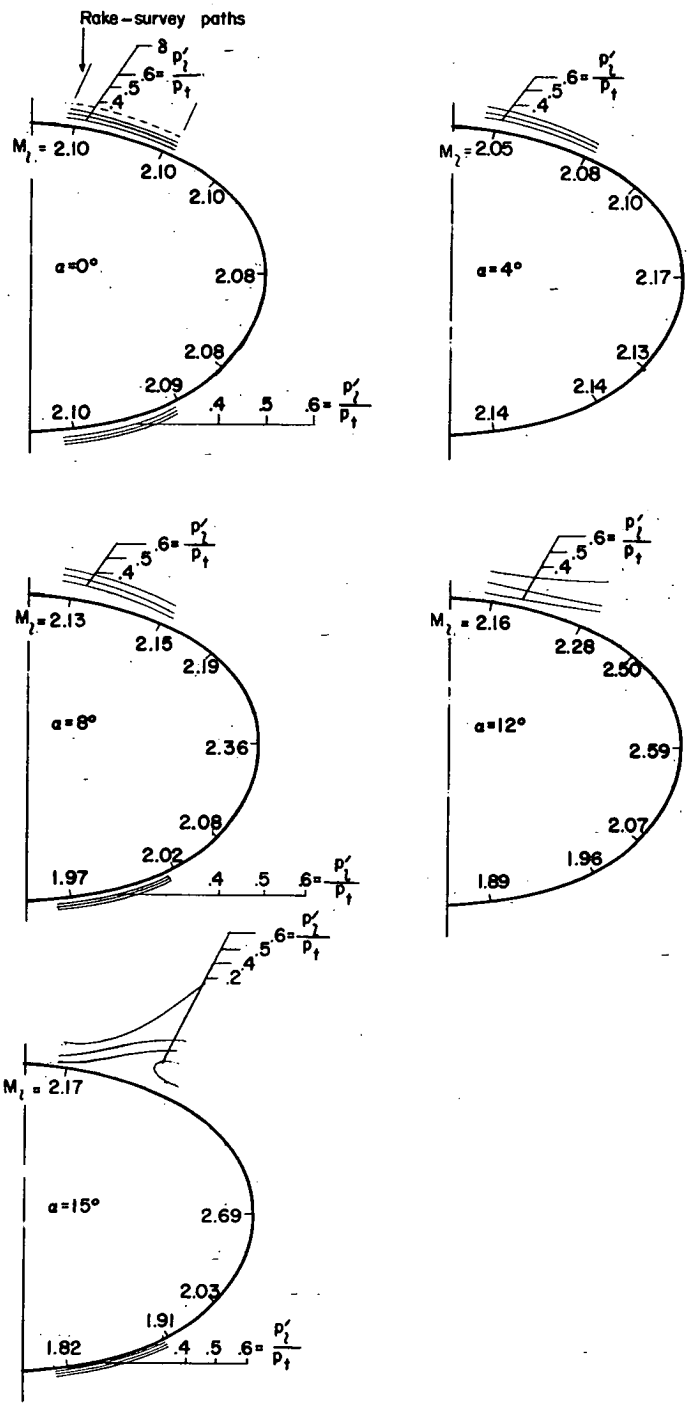
(u) Triangle cross section; station 23.

Figure 6.- Continued.



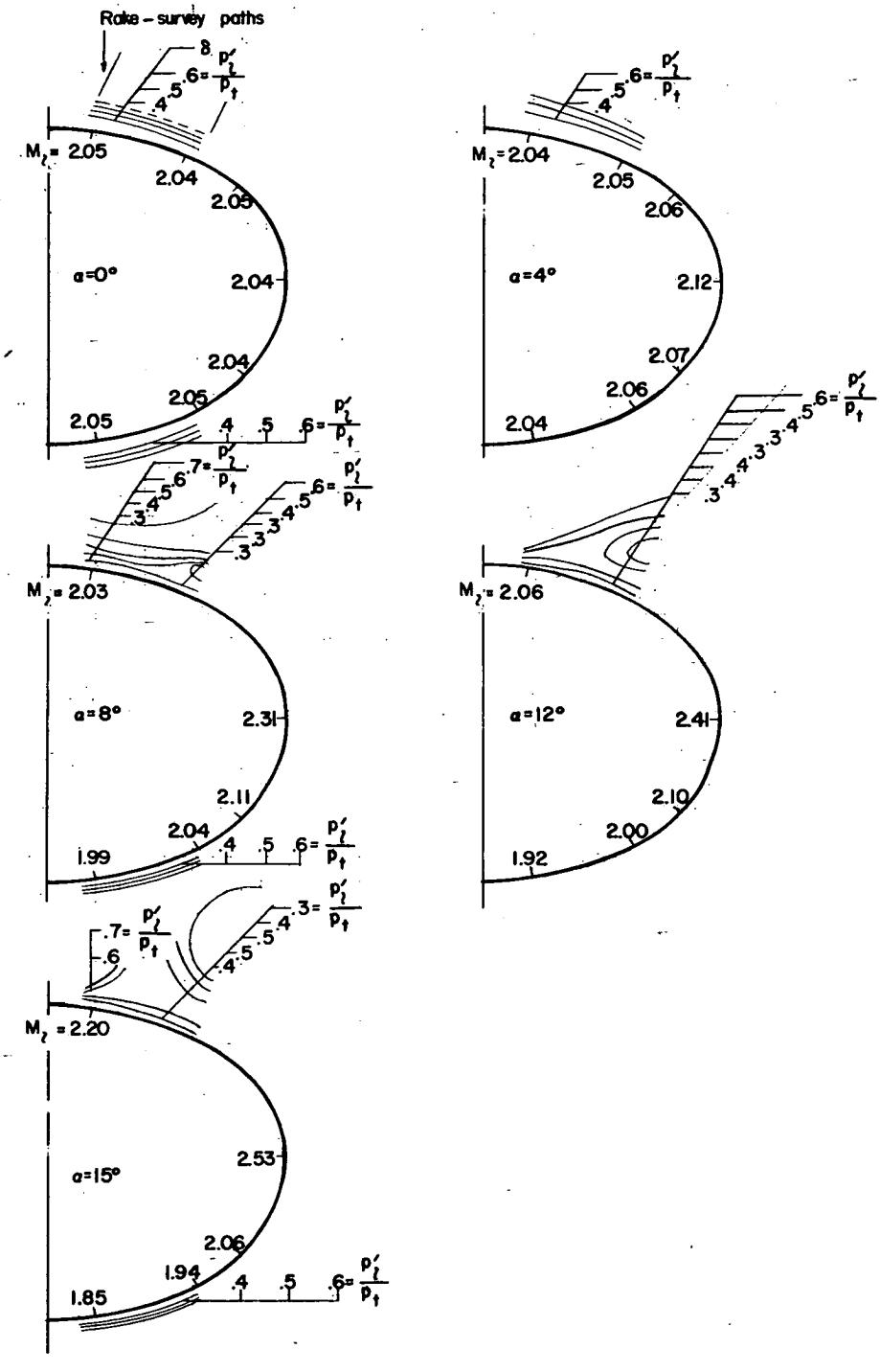
(v) Triangle cross section; station 23.

Figure 6.- Continued.



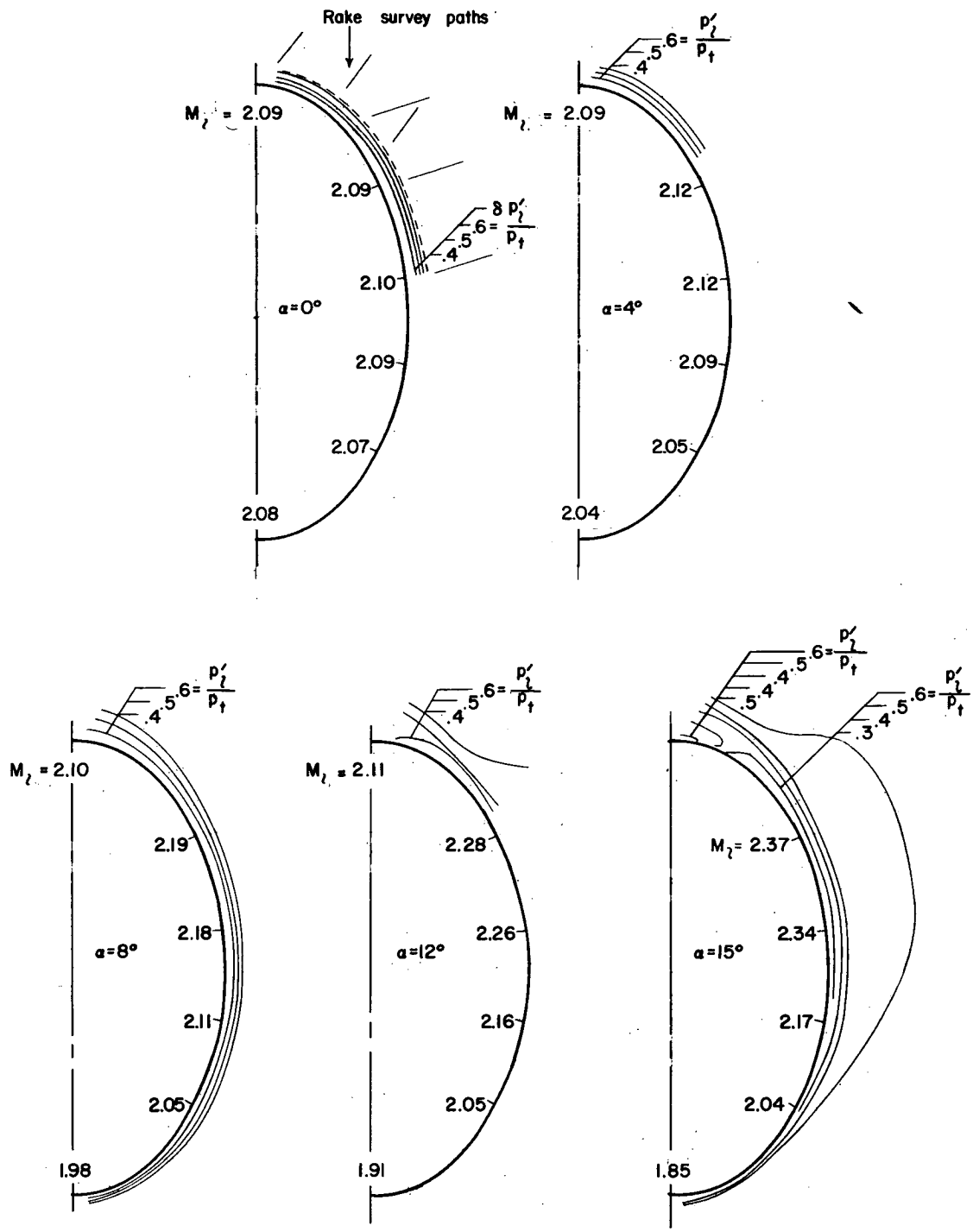
(w) Horizontal-ellipse cross section; station 15.

Figure 6.- Continued.



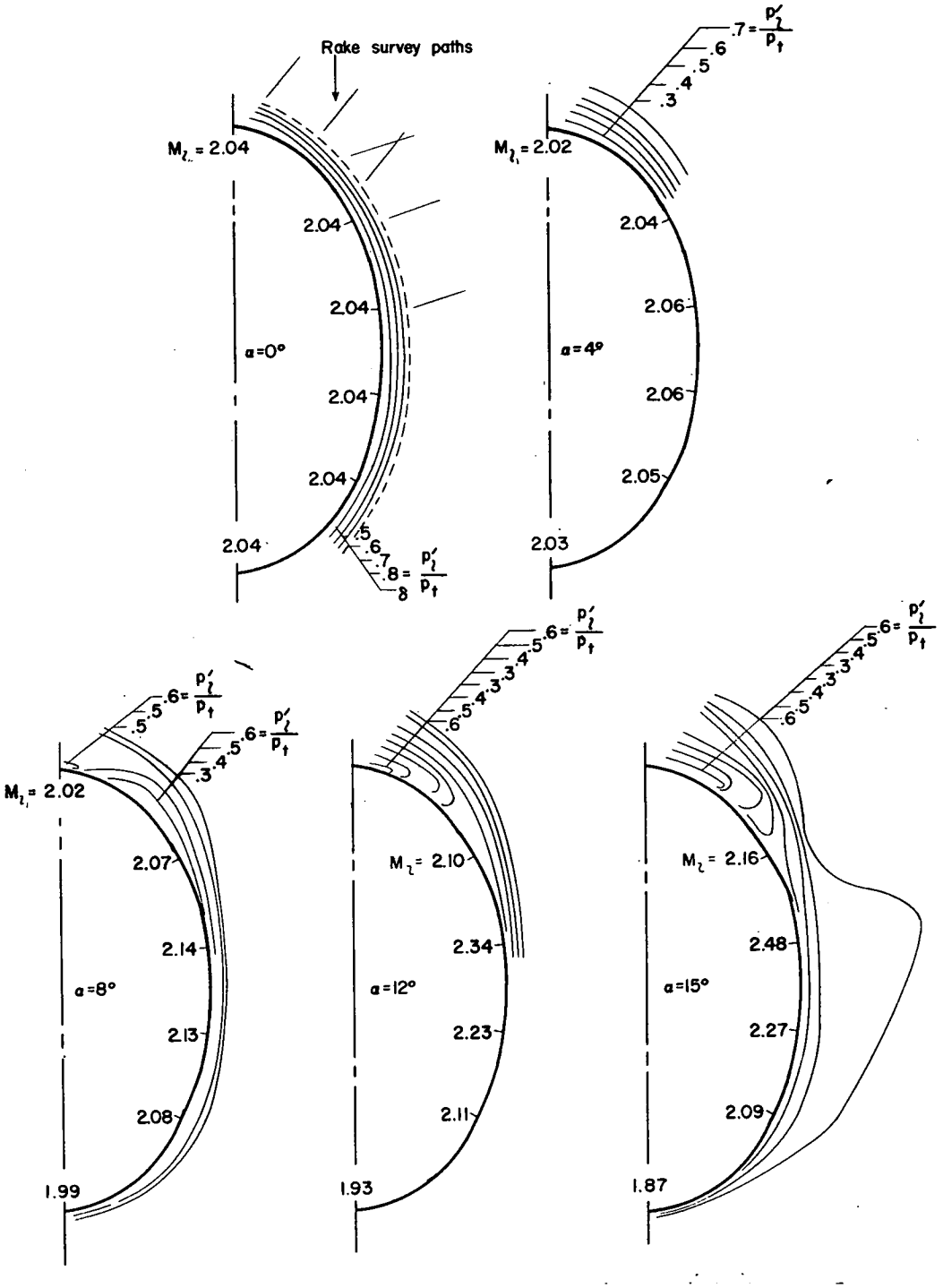
(x) Horizontal-ellipse cross section; station 23.

Figure 6.- Continued.



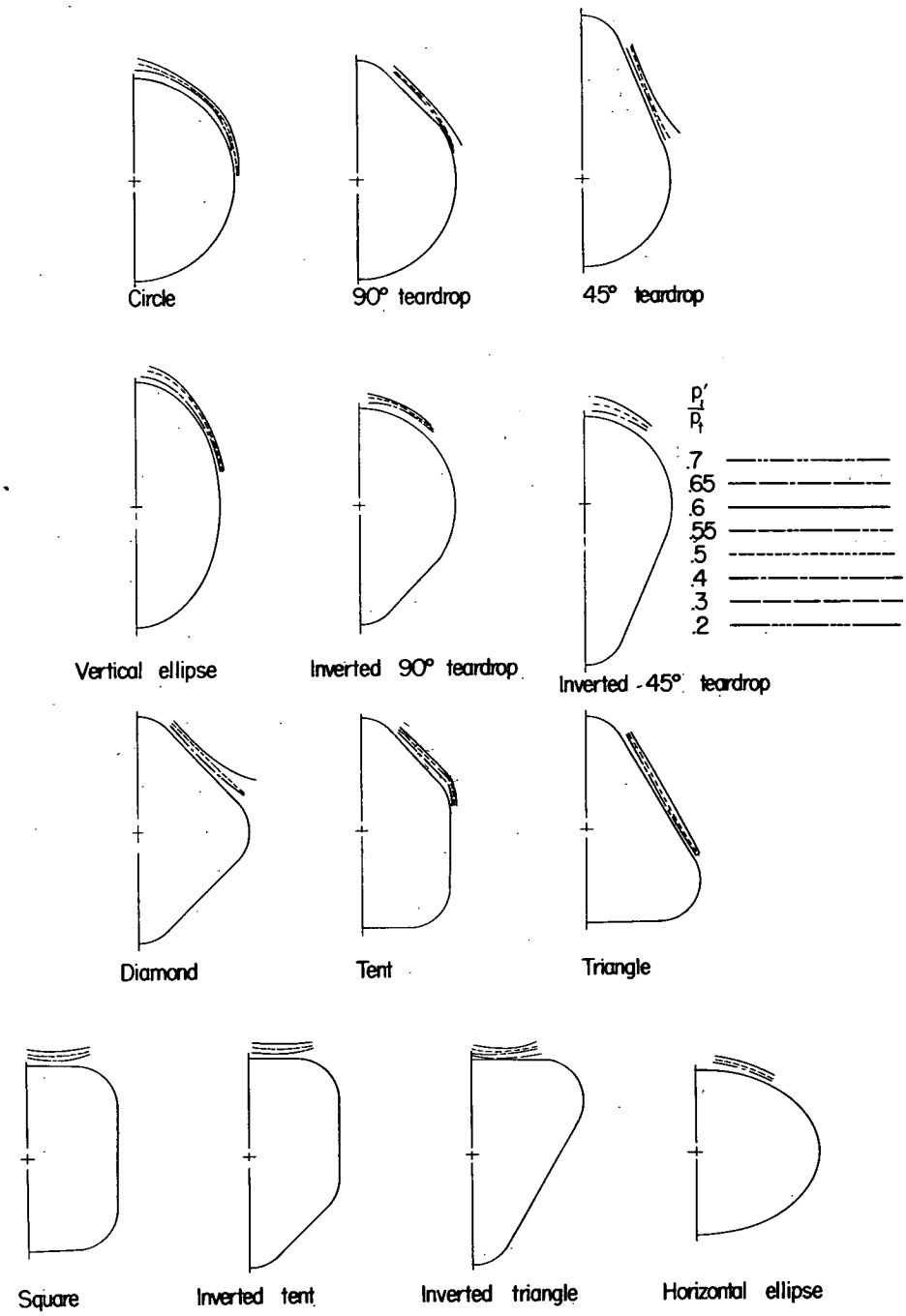
(y) Vertical-ellipse cross section; station 15.

Figure 6.- Continued.



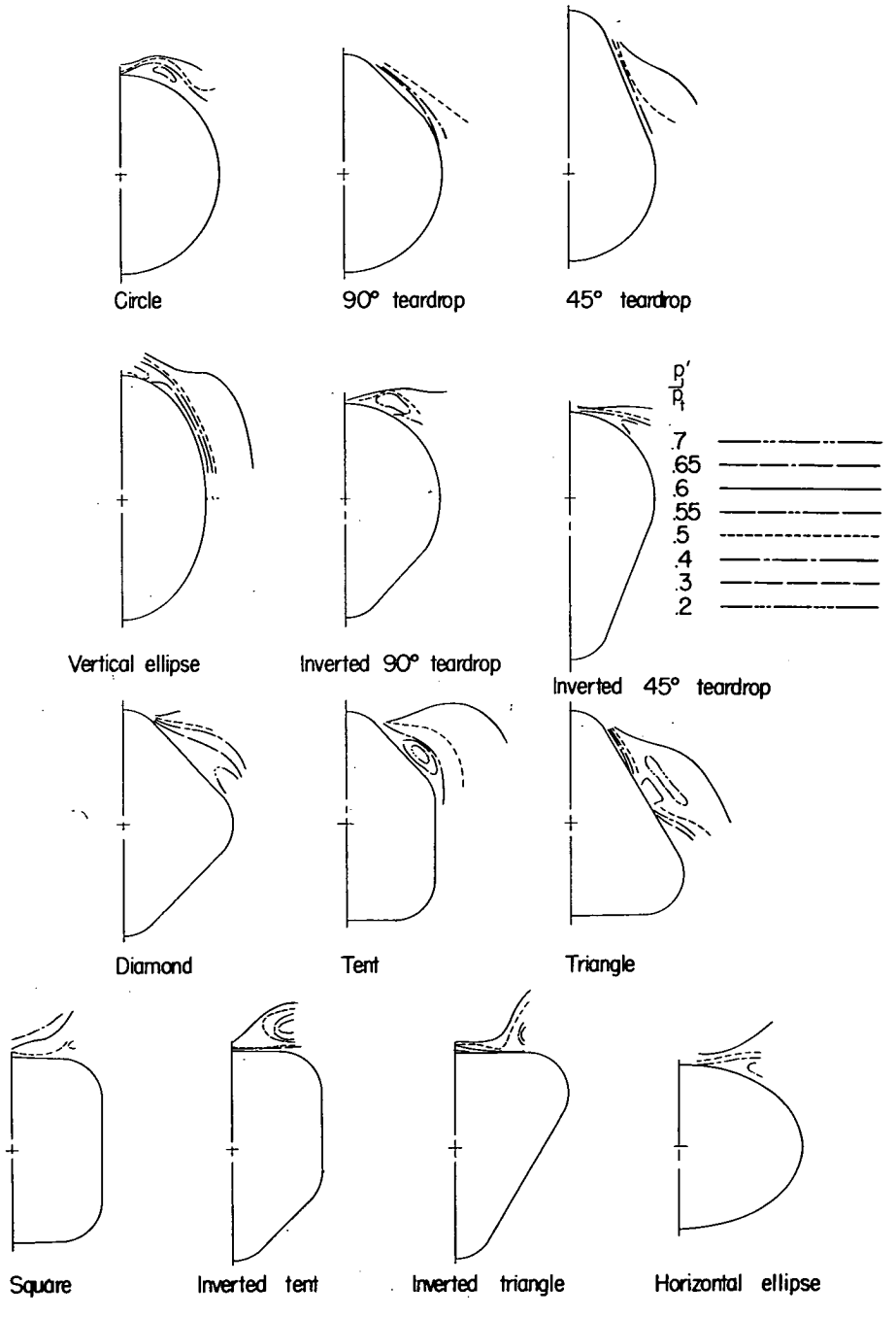
(z) Vertical-ellipse cross section; station 23.

Figure 6.- Concluded.



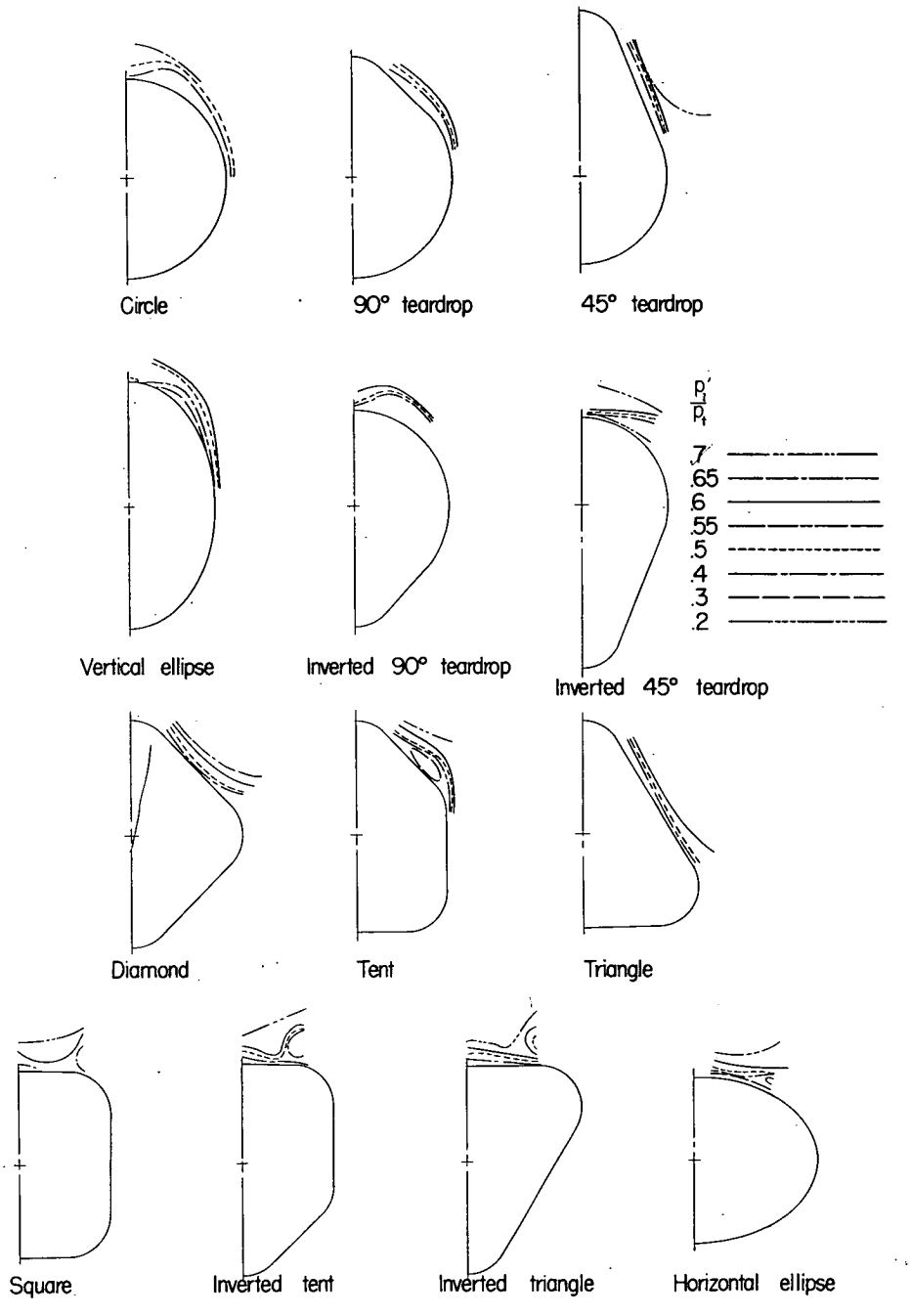
(a) Station 15; $\alpha = 8^{\circ}$.

Figure 7.- Effect at cross-sectional shape on fuselage boundary layer.



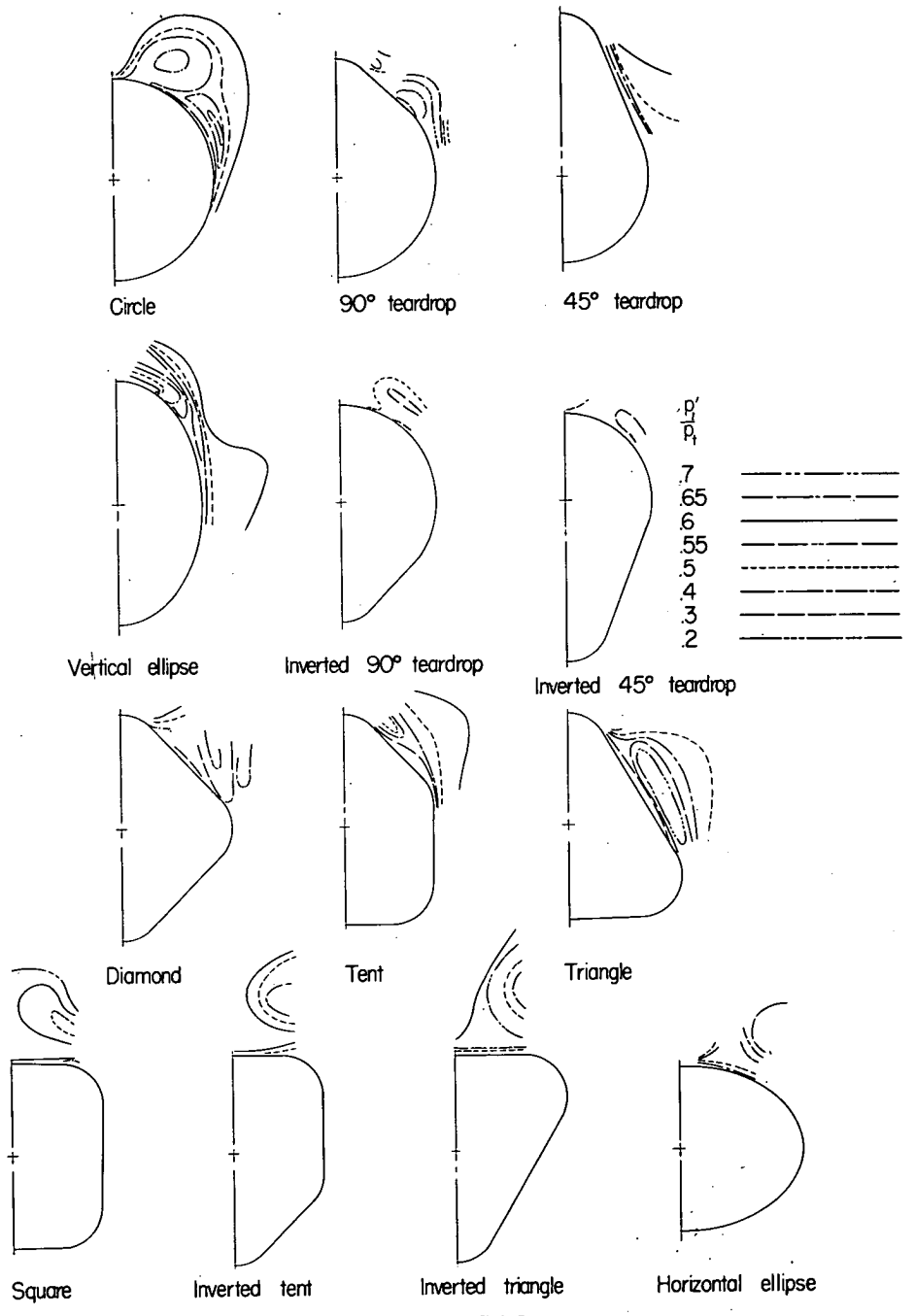
(b) Station 15; $\alpha = 15^{\circ}$.

Figure 7.- Continued.



(c) Station 23; $\alpha = 8^{\circ}$.

Figure 7.- Continued.



(d) Station 23; $\alpha = 15^{\circ}$.

Figure 7.- Concluded.